UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
901 NORTH 5TH STREET
KANSAS CITY, KANSAS 66101

JUN 16 2005

Wayne Gieselman
Environmental Services Division Administrator
Iowa Department of Natural Resources
Wallace State Office Building
502 East 9th Street
Des Moines, Iowa 50319

Dear Mr. Gieselman:

RE: Consolidated Case No. C98-134-MJM: *SAILORS, Inc. and Mississippi River Revival and Sierra Club v. the U.S. Environmental Protection Agency, et al.*

This letter transmits the final report on the Iowa Department of Natural Resources Surface Water Monitoring Program with attention to 303(d) listing. This final report is being issued in accordance with requirements of the Settlement Agreement, which stipulates that Environmental Protection Agency (EPA) agrees to conduct a 36-month assessment study of Iowa's surface water quality monitoring program. The effective date of the Settlement Agreement was December 17, 2001.

An interim report was issued regarding the progress of the Iowa's surface water quality monitoring program study in June of 2003. The enclosed final report includes an enclosure addressing comments received in response to the interim report. Notification of the availability of the enclosed final report will be posted on the EPA Region 7 TMDL website following distribution of copies to the designated recipients.

If you have any questions about this report, please contact John DeLashmit, of my staff, at (913) 551-7821.

Sincerely,

for Leo J. Alderman
Director
Water, Wetlands and Pesticides Division

Enclosure

cc: Chuck Corell, IDNR
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Mike Atkins, SAILORS, Inc.
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Eileen McDonough, USDOJ

An Evaluation: Iowa's Surface Water Quality Monitoring Program with Attention to 303(d) Listing

EPA Region 7

June 16, 2005

CONTENTS

FIGURES

TABLES

1. INTRODUCTION

This report is a summary of the United States Environmental Protection Agency's (EPA's) findings, including recommendations and assessments of the Iowa Department of Natural Resources' (IDNR) surface water monitoring program and Clean Water Act (CWA or "the Act") section 303(d) listing program. Completion of a study of Iowa's surface water monitoring program is one of the requirements established in the settlement of a complaint filed against the EPA by SAILORS, Inc. and Mississippi River Revival and the Sierra Club in 2001.

IDNR's monitoring program is designed to assess compliance of Iowa's rivers, streams, lakes and wetlands with applicable surface water quality standards (WQS). Data collected by IDNR, cooperating agencies, and volunteers are used to identify impaired waterbodies for inclusion on the section 303(d) list. Under Section 303(d) of the CWA, states are required to identify waterbodies for which technology-based controls required by the Act are not sufficient to attain the state's WQS, and prioritize such waterbodies for Total Maximum Daily Load (TMDL) establishment. This report describes and evaluates the data collected and statistical methods used to determine whether a waterbody in Iowa meets applicable WQS.

A brief overview of Iowa's water resources and water quality concerns is presented in the remainder of this section. Iowa's monitoring and listing procedures are described and evaluated in Section 2 and 3. Section 4 provides recommendations for improving IDNR's monitoring and listing programs.

1.1. Iowa's Land and Water Resources

Iowa has an area of 55,869 square miles and is home to 2.9 million people (US Census Bureau, 2001). Iowa has an extensive surface waterbody network that includes 26,630 miles of perennial streams and 42,957 miles of intermittent streams and more than 161,000 acres in lakes, ponds, and reservoirs (IDNR 2003). Selected Iowa waterbodies are classified for designated beneficial uses within the Iowa WQS [Iowa Administrative Code Chapter 567-61]. This state administrative code describes and classifies designated uses for 1,068 streams and stream segments, 279 lakes and 88 wetlands (IDNR 2001; IAC 1990, 1996).

Surface waters in Iowa not classified within Iowa's WQS for designated beneficial uses are classified for general uses, such as livestock and wildlife watering, noncontact recreation, crop irrigation, and industrial, agricultural, domestic and other incidental water withdrawal uses. Only about 17 percent of Iowa's total stream/river miles, and only 46 percent of perennial stream miles, have a designated primary beneficial use (IDNR 2001).

The current estimate of wetland acreage in Iowa is 50,271 acres, although the state has adopted no formally or generally accepted definition of "wetland". The majority of this wetland acreage is located in the prairie pothole region of north-central Iowa. No distinction is made between "lakes" and "wetlands" in the Iowa WQS; however, IDNR indicates that 88 wetlands have been

classified for designated beneficial uses, with 10 wetlands having a primary contact recreational use designation and one wetland having a drinking water designated use.

Publicly-owned lakes constitute 92,816 acres of the more than 160,000 acres of lakes, ponds and reservoirs in Iowa, with flood control reservoirs constituting 40,850 acres of that total. All of the flood control reservoirs and 47,603 acres of the 92,816 acres of publicly-owned lakes have been classified as having designated beneficial uses (IDNR 2001).

The state of Iowa has been subdivided into a series of ecoregions and subregions (Figure 1) that reflect regional variations in ecological and biological conditions (IDNR 2001, Omernik et al. 1993). This division was carried out, in part, to aid the management of aquatic resources and the development of appropriate biocriteria for assessing water quality conditions (IDNR 2001).

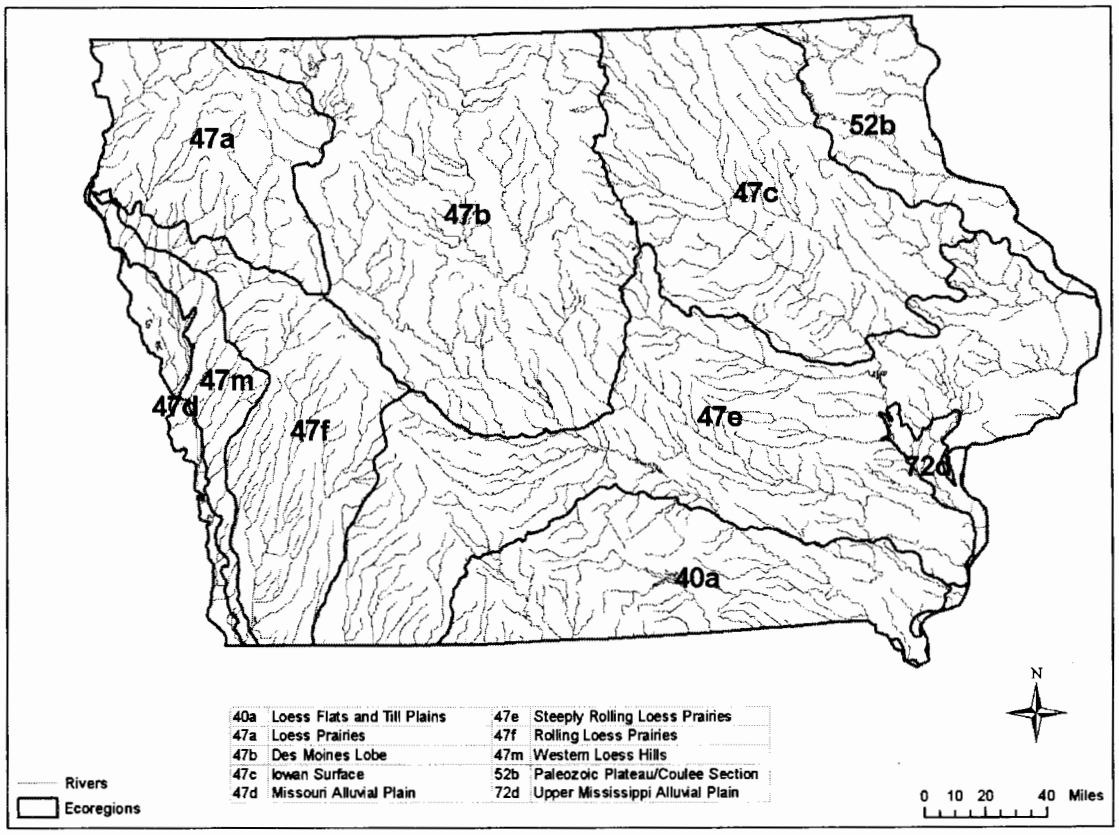

Figure 1. Locations of ecoregions and subregions of the Western Corn Belt Plains ecoregion in the state of Iowa (after Omernik et al. 1993).

1.2. Water Quality Concerns

A number of environmental issues have been identified by IDNR (IDNR 2001). According to IDNR, these issues fall under several major categories and are summarized below:

Agricultural Concerns

- Agricultural nonpoint sources of pollution are the source of many of the impairments to water quality documented in Iowa, in part due to the magnitude of agricultural land use in Iowa (over 85% of the state's surface area is devoted to agricultural uses (USDA 1997)) and the potential for agricultural practices to deliver large amounts of sediment, nutrients, and pesticides to surface waters (IDNR 2001).

- Large-scale concentrated animal feeding operations (CAFOs) have increased significantly in number in Iowa over the last decade. Discharges to streams from such operations have contributed to some of the most extensive fish kills in Iowa that have been documented over the last 25 years (IDNR 2001).

- Agricultural non-point sources and naturally occurring shallowness are primary impairments and urban runoff, municipal point sources and construction contribute to impaired water quality in Iowa's publicly-owned lakes and high priority waterbodies, according to IDNR (IDNR 2001).

Destruction of Aquatic Habitats

- Physical alteration of aquatic habitats (channelization) is the most common cause of impact to the overall quality of Iowa's rivers and streams and limits the ability of streams to support a healthy population of fish. If a pollutant is not identified, hydrologic modification is not, by itself, a basis for requiring a TMDL to be prepared (IDNR 2001).

- In Iowa waters the proliferation of non-native aquatic nuisance species (such as the zebra mussel, Eurasian water millfoil, etc.) has the potential to significantly impact aquatic life and aquatic habitats. Research is needed to identify the most effective methods for controlling impacts resulting from the presence of these species (IDNR 2001).

General Issues

- IDNR reports the existence of anecdotal evidence suggesting that the ability of large rivers to assimilate the cumulative point source discharges of municipal and industrial wastewater treatment plants may have been exceeded in some areas. Factors contributing to this over allocation include failure to adequately account for upstream contributors, lack of adequate monitoring to characterize upstream ambient water quality for determining wasteload allocations (a particular problem along border rivers) and reliance on water quality criteria that do not account for potential toxic impacts in river sediments (e.g., from ammonia) (IDNR 2001).

- Poorly designed and maintained residential wastewater treatment systems are a suspected source of fecal coliform bacteria impacts to state lakes. The extent of this suspected problem is currently undefined (IDNR 2001).

2. IDNR'S SURFACE WATER MONITORING PROGRAMS

Surface water monitoring in the state of Iowa is a responsibility of the IDNR. IDNR's surface water monitoring program utilizes water quality data from several sources for purposes of water quality planning and assessment. IDNR has established a monitoring program strategy and monitoring objectives that guide the development and implementation of its monitoring program. The monitoring program, its goals and objectives, and monitoring coverage are summarized in the following sections. Material used in this compilation include Iowa's 305(b) report for the years 1998 & 1999 (IDNR 2001), Methodology for developing Iowa's 2002 Section 303(d) list of Impaired Waters (IDNR 2002), Comprehensive Report of Ambient Water Quality Monitoring Programs in Iowa (IDNR 2004), the Iowa Water Monitoring Plan (IDNR 2000), and the Water Monitoring Program Highlights 2001-2004 (IDNR 2001-4). See Section 2.2.1 Networks and Programs, of this report, for more discussion of monitoring data.

2.1. Iowa's Monitoring Program Strategy and Objectives

The general purpose of Iowa's monitoring program is to provide quantitative and qualitative information on the physical, chemical, and biological characteristics of the state's surface waters. Goals of surface water monitoring are as follows (IDNR 2000):

1. Define the condition of Iowa's water resources.

2. Characterize existing and emerging problems by type, magnitude, and geographic extent.

3. Provide information for designing and implementing abatement, control, and management programs.

4. Measure changes and identify trends in water resource quality.

5. Provide information to evaluate program effectiveness.

6. Report information in useful formats to inform Iowa's citizens about their water resources.

7. Involve Iowa citizens in monitoring to increase their appreciation and understanding of their water resources.

2.2. Iowa's Monitoring Programs

2.2.1. Networks and Programs

The Iowa surface water quality monitoring program consists of both IDNR managed monitoring networks and programs and those of cooperating agencies. Figure 2 illustrates the locations of all monitoring stations within this linked network. This section discusses monitoring networks and programs representing significant components of IDNR's integrated surface water monitoring program.

IDNR maintains a system of fixed monitoring stations that are targeted toward medium to large-sized interior streams in the state (IDNR 2001). Sixty-two fixed stations are monitored monthly to provide uniform state-wide coverage of eight-digit hydrologic unit code (HUC 8) basins (basins with >250,000 acres). Analytes include common herbicides, bacteria indicators and all priority pollutants (April through July only). Seven of these 62 stations (1 in each ecological region) are further targeted for supplemental sampling during run-off events. Fourteen of the larger interior cities are monitored monthly, both upstream and downstream, at 27 sites to look at aggregate urban effects on water quality (IDNR 2004). In 2003, four additional sites (Charles City, Shenanadoah, Sac City and Independence) were paired with existing ambient sites to maximize information on urban influences (IDNR 2003). Priority pollutants are monitored at these sites on a monthly basis from April to July. Figure 3 illustrates station locations of monitoring points within IDNR's STORET database, which includes all monitoring locations within their fixed station network.

One hundred and thirty-two lakes in the state are currently being monitored 3 times per year as part of a five year monitoring program to document annual variability among lakes as well as general variability within each lake (IDNR 2002b) (Figure 4). In 2003, parameters included, particle size distribution and dissolved organic carbon (IDNR 2003). Two additional beaches were added to the monitoring programs in July 2003 – North Twin Lake East and North Twin Lake West in Calhoun County. New parameters in 2004 included the determination of metals and priority pollutants in lake sediments and cyanobacteria toxins (microcystin). Sampling in 2004 represented year five of a five-year study (IDNR 2005). In 2004, lakes were also sampled for the pesticide Balance through early season (ice-out) and late season (October) (IDNR 2005). A variety of field, chemical, and biological parameters have been monitored including secchi disk transparency, temperature profile, pH and pH profile, dissolved oxygen profile, total dissolved solids profile, specific conductivity profile, turbidity profile, chlorophyll-a and pigment profile, total phosphorus, dissolved phosphorus, nitrite (NO2) + nitrate (NO3), anhydrous ammonia (NH4), un-ionized ammonia (NH3), total nitrogen, silica, alkalinity, total suspended sediment, inorganic suspended solids, volatile suspended solids, phytoplankton composition, zooplankton composition, and priority pollutants (IDNR 2002b). Thirty-five state-owned beaches have also been monitored, weekly, from April 15 through October 31, for indicator bacteria (fecal coliform, Enterococci, E. coli), total suspended sediment, dissolved oxygen, pH, temperature, and turbidity (IDNR, 2000).

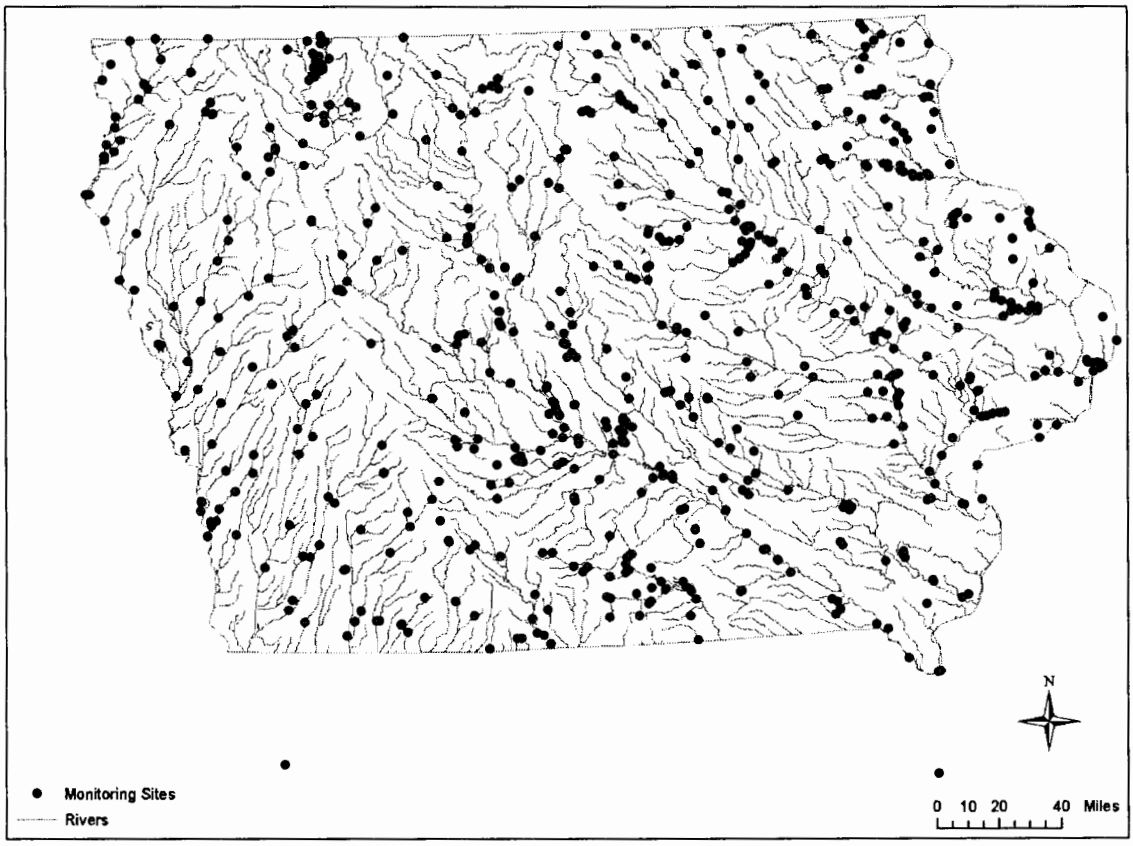

Figure 2. Locations of All Sampling Sites with Location Data from IDNR Databases, 1998-2003. The two data points located south of Iowa's borders represent data collected by neighboring states on the Missouri and Mississippi Rivers which is also evaluated by Iowa.

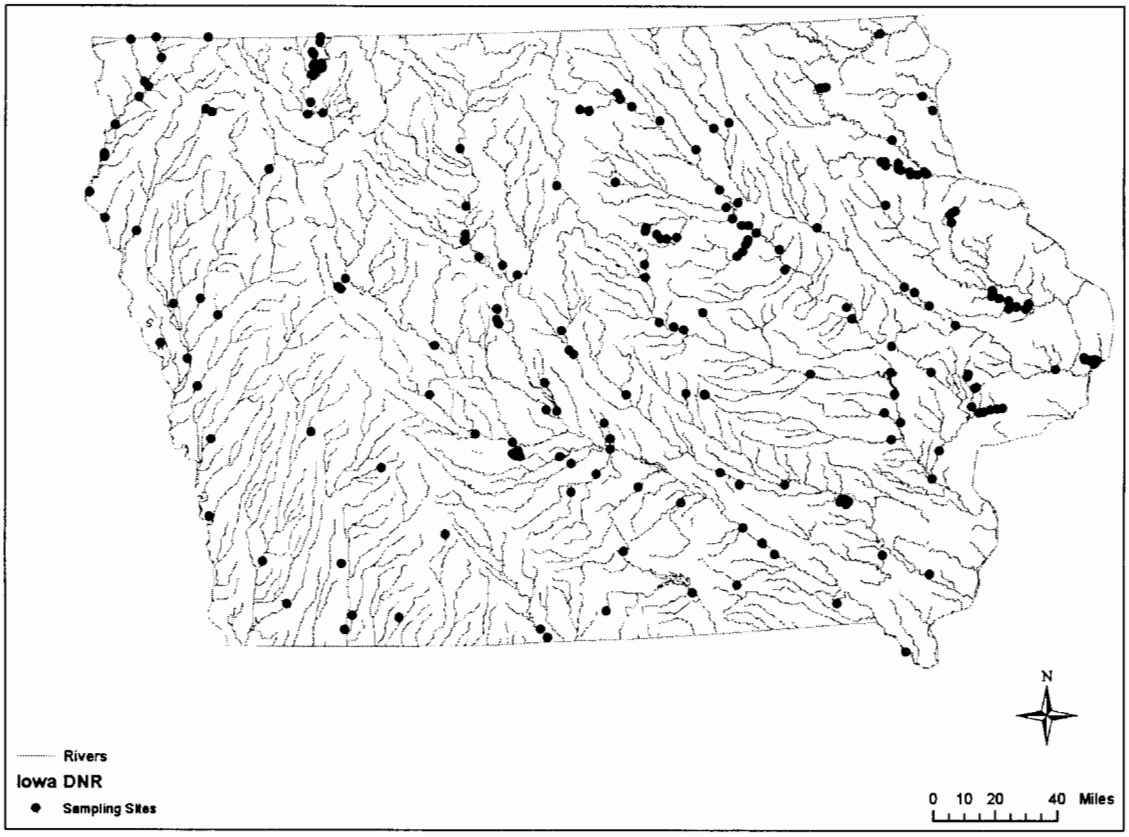

Figure 3. Locations of Sampling Sites with Location Data from IDNR STORET Database, 1998-2003. These Data include fixed stations within the ambient monitoring program, beach sampling sites, sampling sites associated with major cities, etc.

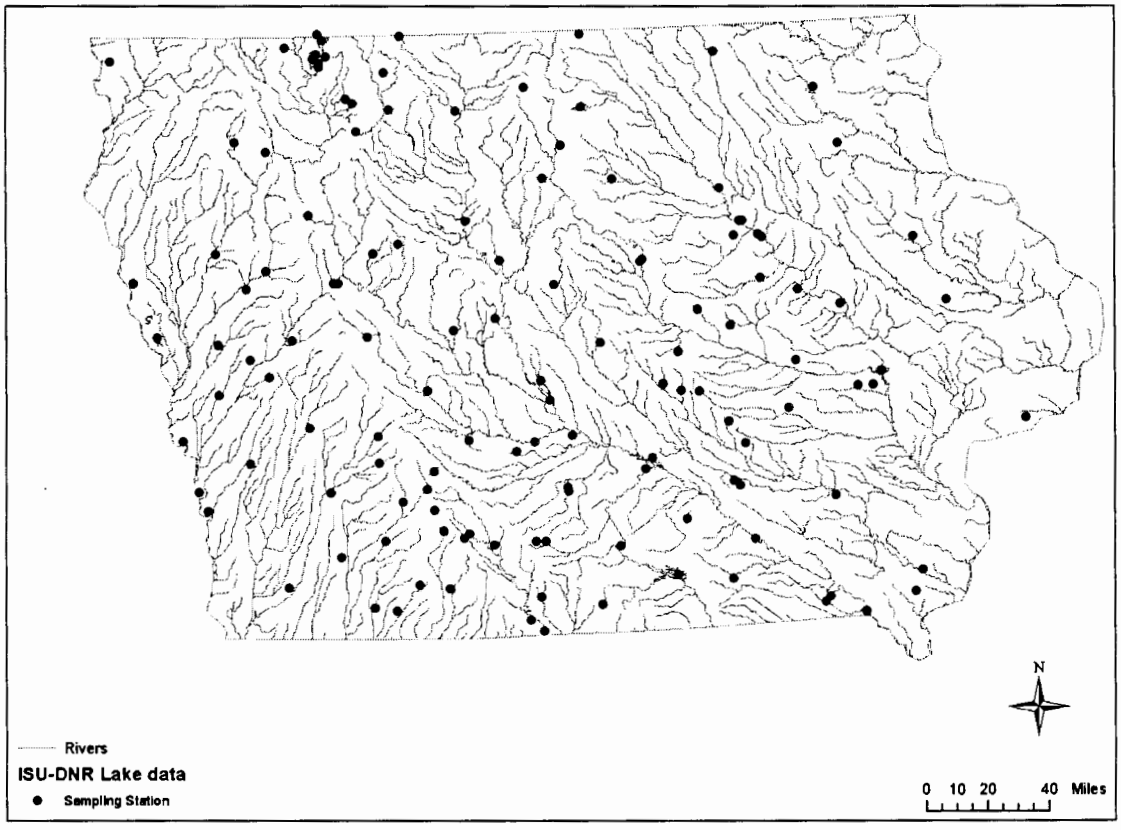

Figure 4. Locations of Sampling Sites with Location Data from the ISU-DNR Lakes Study, 2000-2003.

Since the 1998-99 Section 305(b) reporting cycle, IDNR has been using biological criteria (biocriteria) to assess support of aquatic life uses at selected locations and annually collects biocriteria data from a series of sampling stations in the state (IDNR 2001). Biocriteria are indicators of stream biological integrity which utilize the Benthic Macroinvertebrate Index of Biotic Integrity (BM-IBI) and a Fish Index of Biotic Integrity (F-IBI) to summarize biological sampling data and provide a broad assessment of stream biological conditions (IDNR 2002). To date, approximately 320 stream segments have been sampled either for reference conditions or evaluation purposes (Figure 5). Currently approximately 40 different test sites are sampled per year (IDNR 2003). Repeat sampling at individual locations are expected to occur on about a 5 year cycle (Olson 2003).

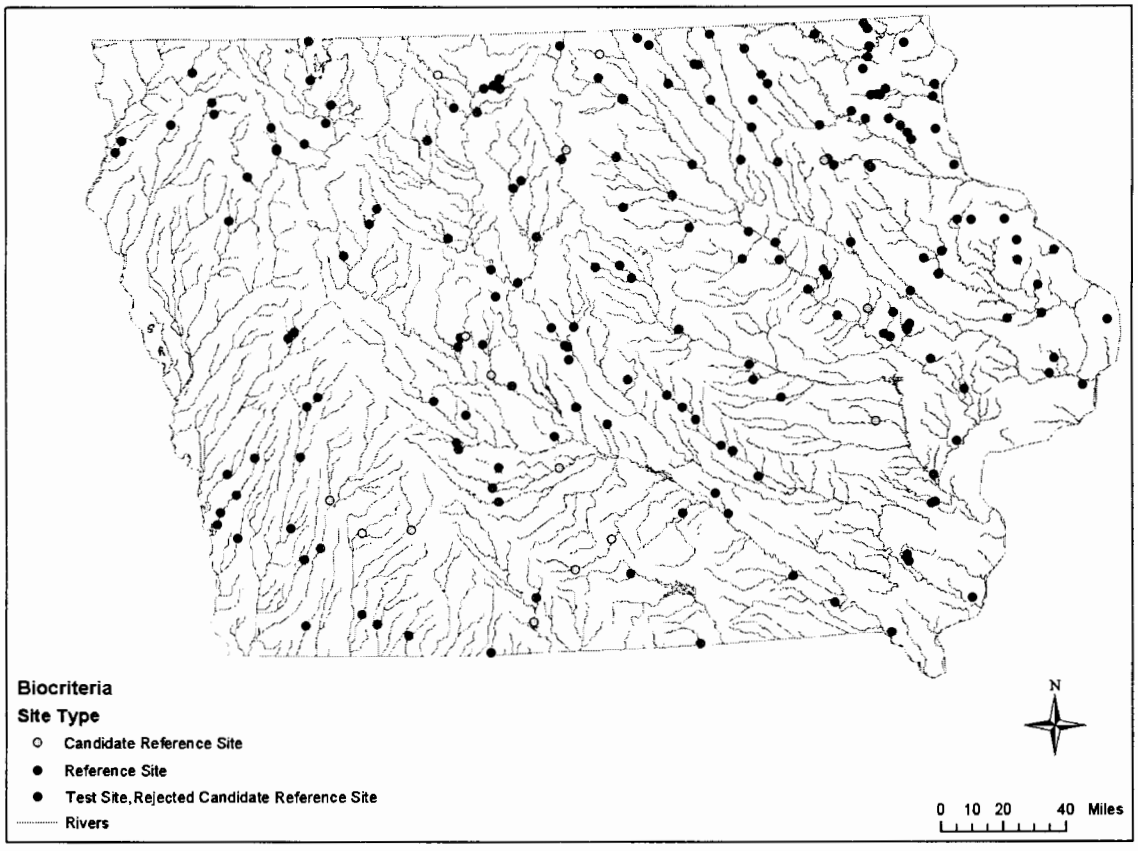

Figure 5. Locations of Sampling Sites with Location Data from the IDNR Biocriteria Database, 1998-2003. Rejected Candidate Reference Sites were sites initially considered as possible references sites that were rejected and are now considered test sites.

Fish kill reports are routinely investigated either by IDNR's Fisheries Bureau or IDNR's Compliance and Enforcement Bureau. From 1996 through 2001, IDNR reported 126 fish kills. Out of the 126 fish kills, 70% were from human causes and 30% were from natural or known causes (IDNR 2003). Data from these investigations, including the location, size, and source are recorded in IDNR's Fish Kill Database and used in the water quality assessment process.

IDNR recently initiated a probabilistic survey of the state's stream resources as part of the R-EMAP program (A probabilistic survey provides a statistical procedure to assess the overall conditions of the state's waters.) This survey, which began in 2002 and continued in 2004, is projected to be completed over a five-year period and targets randomly selected stream sites in each of Iowa's ten ecological regions (IDNR 2005). A total of 225 stream segments will be selected with approximately 25% of the selected sites being sampled every year. In the summer of 2004, 45 of the sites were monitored. IDNR received a grant from EPA for Wadeable Steam Assessment, which has allowed the IDNR to work with Iowa State University to gather habitat data at all 45 sites using both the EMAP and the IDNR habitat protocols (IDNR 2005). The survey is intended to gauge stream ecosystem health through the following five major sampling components: 1) aquatic community (benthic macroinvertebrates and fish); 2) fish tissue and sediment contaminants; 3) primary productivity and aquatic community respiration; 4) water chemistry; and 5) riparian and stream physical habitat (IDNR 2003). 109 reference sites, located throughout the state, have been established as benchmarks for benthic macroinvertebrates (bottom-dwelling organisms) and fish populations.

In addition to IDNR-directed monitoring, IDNR also coordinates water quality monitoring activities with several other agencies that conduct their own surface water quality monitoring in Iowa. Long-term ambient water quality monitoring is being conducted by several cooperating agencies. The U.S. Army Corps of Engineers (USACE) has contracted with both Iowa State University at Ames and the University of Iowa at Iowa City to conduct water monitoring at federal flood control reservoirs on the Des Moines and Iowa rivers (Figure 6). The U.S. Fish and Wildlife Service collects biweekly to monthly water quality data from March to September on Walnut and Squaw Creeks as part of the Walnut Creek Watershed Restoration and Water Quality Monitoring Project. IDNR also evaluates water quality data collected by the Cedar Rapids Water Department and Des Moines Water Works.

The IDNR is working with the Rathbun Land and Water Alliance (RLWA) to supplement existing monitoring on Rathbun Lake and to support future studies to measure the nutrient flux within the watershed. The Rathbun Lake Watershed Project is a monthly water quality sampling initiative conducted by the RLWA whose intent is to monitor for water quality impacts and to assess threats to this regionally important water supply reservoir.

The United States Geological Survey (USGS) has conducted sporadic sampling at up to 39 stream sites in Iowa as part of the National Ambient Water-Quality Assessment Program (NAWQA)(see May et al. 1999 and Nalley et al. 2000). Sampling has recently entered a low-intensity phase – continuing on a regular basis at only four sites. Data from these four sites are utilized by IDNR in their assessment program (Olson 2003). The USGS also collects data at two

fixed stations on Iowa's border rivers as part of the National Stream Water Quality Network (NASQAN). These two stations are located on the Mississippi River at Clinton and on the Missouri River at Omaha. USGS data on border rivers is supplemented with data provided by environmental agencies of neighboring states who maintain fixed monitoring stations on these rivers. IDNR currently does not conduct state-directed monitoring on the large border rivers. In 2002, biological assessments comprised four types of sites. There were 16 ambient sites for benthic macroinvertebrates. There were 20 reference sites used to set biological criteria. There were 40 test sites gaging a stream's biological health as impacted by disturbances such as channelization, live-stock grazing, manure spills, wastewater discharges and urban runoff. Finally, there were 48 watershed sites used to determine the location and condition of biological impairment in a watershed and used to develop TMDLs.

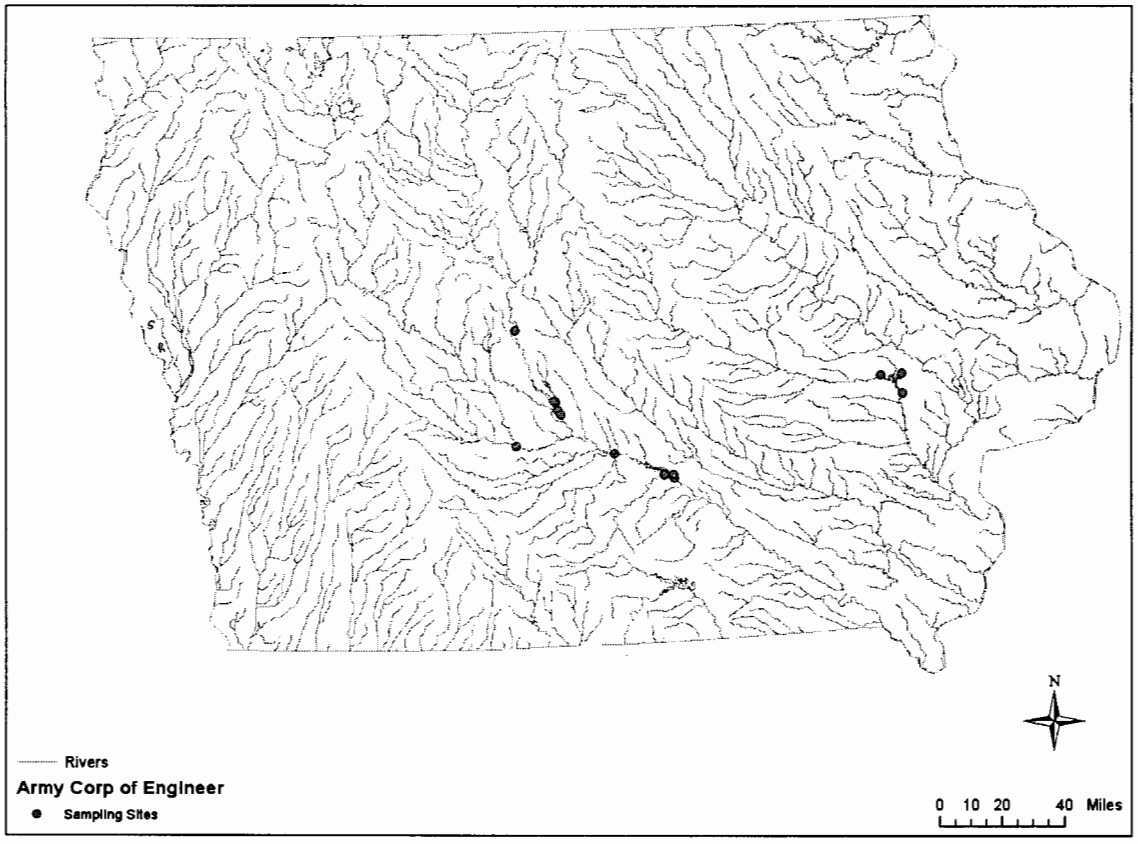

Figure 6. Locations of USACE Sampling Sites in Iowa with Location Data from IDNR Database, 1998-2003.

Annual monitoring for bioaccumulative toxics in fish tissue is currently conducted in Iowa as part of two long-term programs: 1) EPA's Regional Ambient Fish Tissue (RAFT) Monitoring Program (Figure 7), and 2) water quality studies being conducted as part of the USACE reservoir monitoring program. Sampling locations for the latter program are located on the Des Moines river near Saylorville and Red Rock Reservoirs and on the Iowa River near Coralville Reservoir (IDNR 2002). Sporadic fish tissue monitoring is also conducted by USACE at Rathbun Reservoir. The RAFT program currently involves analysis for 19 pesticides and 4 toxic metals. The RAFT program further entails monitoring for trends in levels of toxics in bottom feeding fish (common carp) at ten fixed sites on Iowa's larger rivers as well as follow-up monitoring designed to determine if contaminant levels are sufficiently high to warrant issuance of consumption advisories (IDNR 2002).

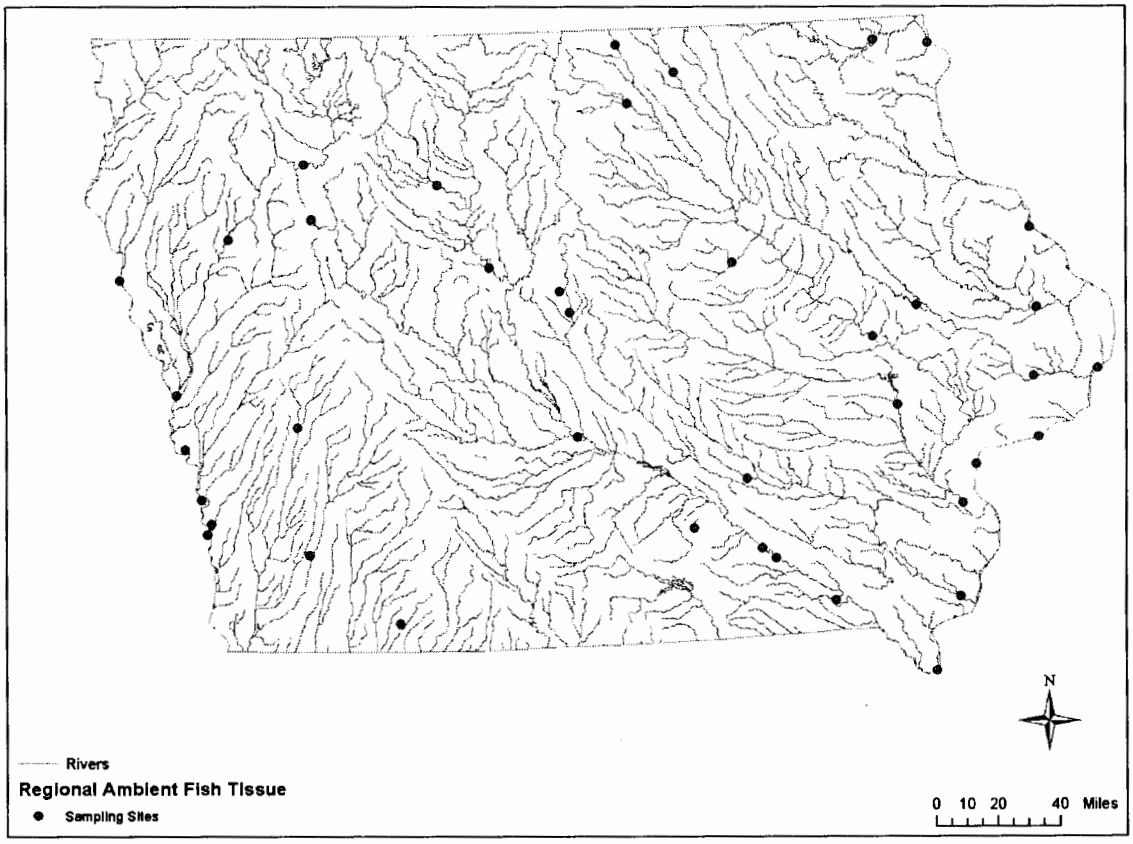

Figure 7. Locations of Regional Ambient Fish Tissue (RAFT) Sampling Sites in Iowa from U.S. EPA's STORET Database, 1998-2003.

The Iowa volunteer monitoring program (IOWATER) was established in 2000 and provides training, equipment, and supplies to volunteers collecting monitoring data on streams throughout the state. The volunteer program currently provides two levels of training. Level one training includes: a simple habitat assessment, manual measurements of stream flow, and chemical tests using field kits for nitrate, phosphorus, pH, training for standing waters (lakes, ponds, wetlands) and soil, and dissolved oxygen. Level two training includes test methods for bacteria and chloride, and quantitative assessment of macroinvertebrates. Iowa has been able to greatly expand the surface water monitoring network to achieve reasonable progress toward comprehensive coverage of interior rivers using a variety of good monitoring designs and increasing resources (IDNR 2004b). Guidance on preparation of quality assurance project plans is also provided to ensure that the data volunteers collect is of high quality (IDNR 2004). IOWATER testing methods continue to be assessed for credibility (accuracy and precision). Ongoing comparison of the data to professionally collected data show confidence in IOWATER results and methods. Methods that are acceptable for 305(b) assessment are also being investigated (better detection limits, resolution) (IDNR 2005). While not collected as part of the IOWATER program, atrazine data collected by Syngenta is detailed in Figure 8.

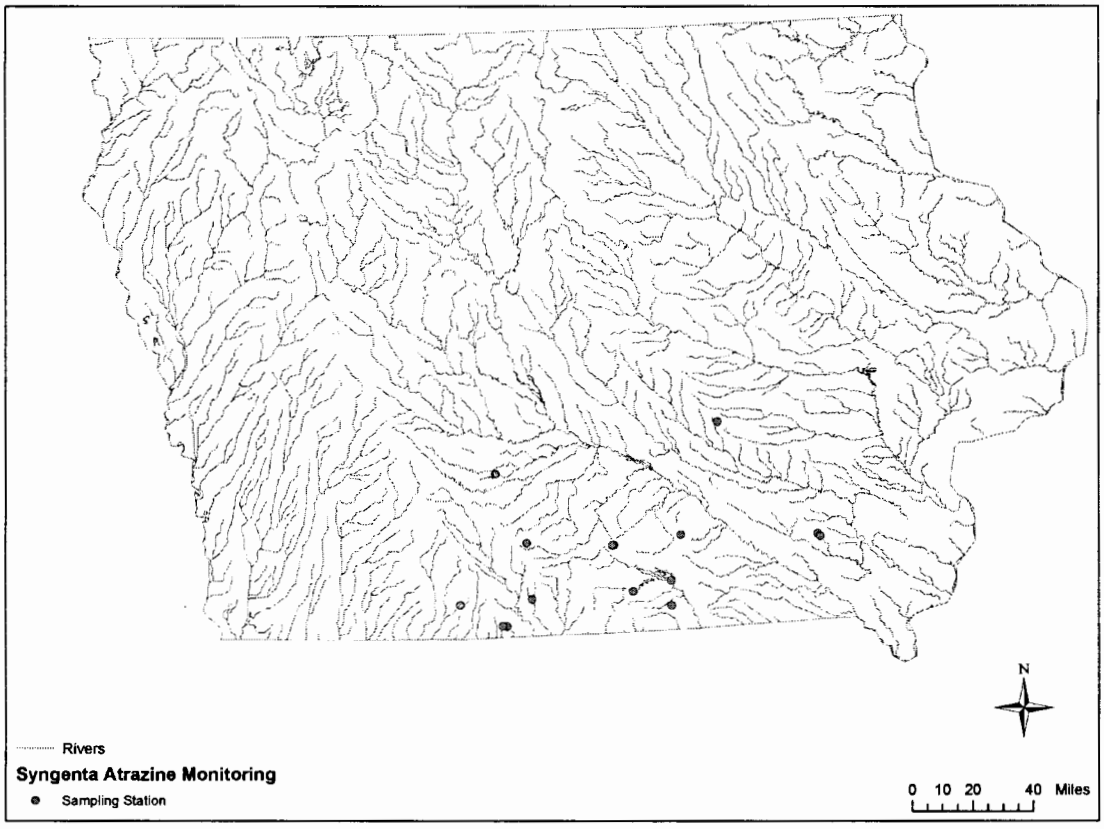

Figure 8. Locations of Sites Sampled by Syngenta for Atrazine, 1998-2003.

To avoid duplication of effort, all of the foregoing monitoring programs developed by outside agencies and groups have been taken into account in the design of IDNR's ambient water quality monitoring network. Data from the foregoing sampling efforts are then used in combination with IDNR-generated data to evaluate surface water quality in the state and assess progress toward attaining IDNR's monitoring objectives.

With regard to the state's wetlands, IDNR is working on updating the National Wetland Inventory (NWI) for Iowa since the first map was created in the 1980s. A R-EMAP grant to begin development of wetland monitoring techniques and identification of reference wetlands was funded by EPA. Formation of a wetland technical advisory group began in April of 2004, and has met four times during the past year (IDNR 2005). The sampling frame was delivered to EPA in April of 2005, and sampling is projected to begin in 2005 (IDNR 2005). IDNR received a wetland development grant to develop a rapid assessment method for Iowa fens (Fens are peat - forming wetlands that receive nutrients from sources other than precipitation, usually from upslope sources through drainage from surrounding mineral soils and groundwater movement.) Work in early 2005 includes a review of existing GIS data on fen locations to determine whether or not the 1990 inventory is still accurate (IDNR 2005).

2.2.2. Quality Assurance/Quality Control Program

The IDNR Environmental Protection Division has developed and adopted a quality management plan (IDNR 1998) that describes the quality assurance policies and procedures that have been established to ensure that all environmental data collected by the division are of known and documented quality. This quality management plan also identifies the programs and environmental data collection activities covered by the Division's quality assurance program and the quality assurance roles and responsibilities for Division staff involved in the collection of environmental data (IDNR 2001).

All IDNR monitoring networks and special studies are further governed by a quality assurance/quality control (QA/QC) work plan. IDNR QA/QC work plans have been developed in accordance with EPA's Guidance for Quality Assurance Project Plans (EPA, 1998) (IDNR, 2001).

2.2.3. Data Storage/Access

Historically, IDNR had entered all water quality monitoring data generated by routine ambient IDNR monitoring programs in EPA's STORET database. This practice ended after 1998 when an updated EPA STORET system was introduced. A transitional period occurred between the two systems from 1999 to 2000 when data were temporarily stored in excel data files but those data have now been transferred into the new system. Currently, all ambient monitoring data is being directly entered into the new EPA STORET system. The new EPA system is designed to run on Oracle and is installed on a server which allows direct access through the Internet. Internet access currently allows limited data searches and will eventually be expanded to include mapping and graphing capabilities (IDNR 2001, IDNR 2002b).

Storage of monitoring data collected by cooperating agencies and as part of specialized projects is currently fragmented with much of it being held in separate Microsoft Excel data files. Plans are in progress to coordinate the entering of this data into STORET and, thereby, consolidate most of the data used in IDNR's assessment program.

IDNR is in the process of transferring data collected as part of the biological monitoring program to EPA's Ecological Data Application System (EDAS) biological database. All future biological data generated through the biological monitoring and TMDL programs is expected to be entered into this database (IDNR 2002b).

2.2.4. Characterization of Iowa's Monitoring Stations

Information Used in Analysis

IDNR's STORET database of ambient surface water quality data and data files of water quality data from other projects and sources were obtained from IDNR and used for this analysis. The data obtained represent, to the extent ascertainable, data currently being used by IDNR to assess compliance with state surface WQS and to determine support of designated beneficial uses. This data analysis focuses on the 5 most recent years of sampling and consists of data from over 700 sampling locations from the following sampling programs:

- IDNR fixed station water quality monitoring network;
- Biological monitoring being conducted by IDNR in cooperation with the University of Iowa Hygienic Laboratory (UHL) as part of a current effort to establish biological criteria
- IDNR-sponsored lake monitoring conducted by Iowa State University;
- Monitoring of bacterial indicators in rivers and at beaches of publicly-owned lakes;
- Water quality monitoring from neighboring states of IL, NE, and SD
- US Army Corps of Engineers reservoir monitoring
- USGS NAWQA & NASQAN monitoring programs
- Volunteer Monitoring Program (Syngenta atrazine monitoring)
- Rathbun Lake Watershed Project
- Walnut Creek Watershed Project
- Where available, data from public water supplies on the quality of raw and finished water

In addition to the sampling data, IDNR also provided station location information for the majority of the sampling stations. Location information was either in the form of latitude and longitude or was converted to latitude and longitude for purposes of this study. Other information used in the analysis included GIS coverage of the 6-digit, 8-digit, and 12-digit Hydrologic Unit Code (HUC) watersheds.

Analysis Approach

GIS analysis of station location data focused on the spatial distribution of monitoring stations and assessed how representative that distribution was of 8-digit and 12-digit HUC coverage. Specifically, sampling station location information was used with the Spatial Join function in ArcView to determine the number of stations located in 8-digit and 12-digit HUCs. The results of this analysis are presented in Table 1 and Figures 9 and 10. Figures 9 and 10 display the location and number of sampling sites by 8- and 12- digit HUC for the assembled data. Figure 11 shows the location of the major river basins, while Table 2 shows the distribution and percentage of sampling sites by major river basin.

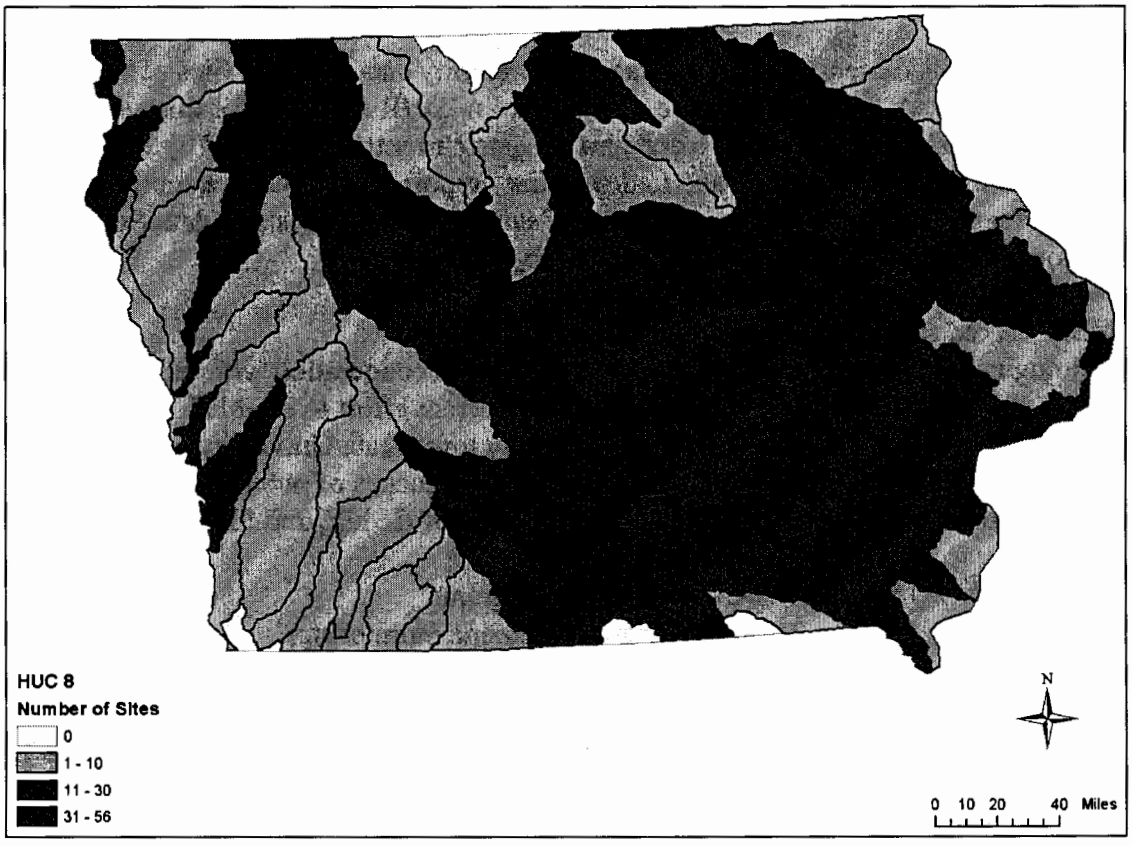

Figure 9. Distribution of Iowa Sampling Sites by 8-digit HUC with Location Data from IDNR Databases, 1998-2003.

Table 1. Number of Sampling Sites per 8- and 12- Digit HUC in Iowa.

HUC Type	No Sites	1-10 Sites	11-30 Sites	More than 30 Sites	Total
8-digit HUCs	6	33	21	5	65
HUC Type	**No Sites**	**1-10 Sites**	**11-30 Sites**	**More than 30 Sites**	**Total**
12-digit HUCs	1231	460	8	3	1702

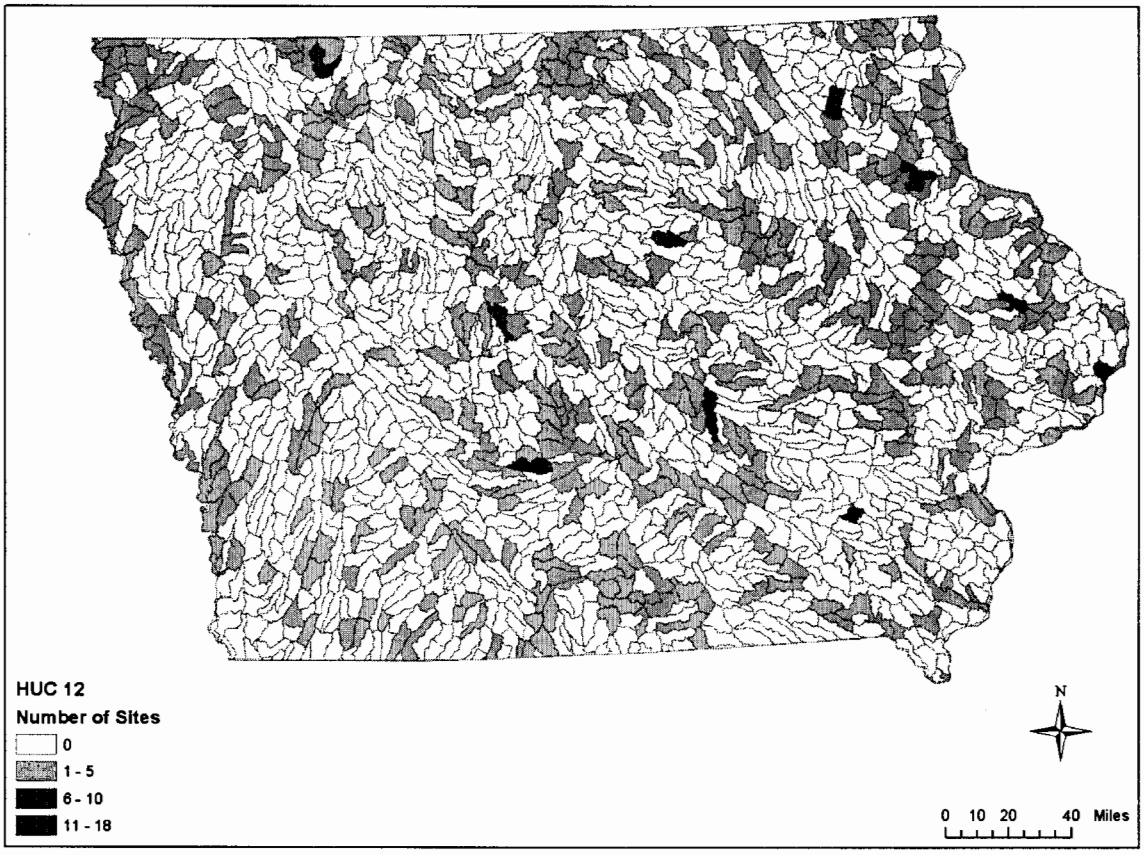

Figure 10. Distribution of Iowa Sampling Sites by 12-digit HUC with Location Data from IDNR Databases, 1998-2003.

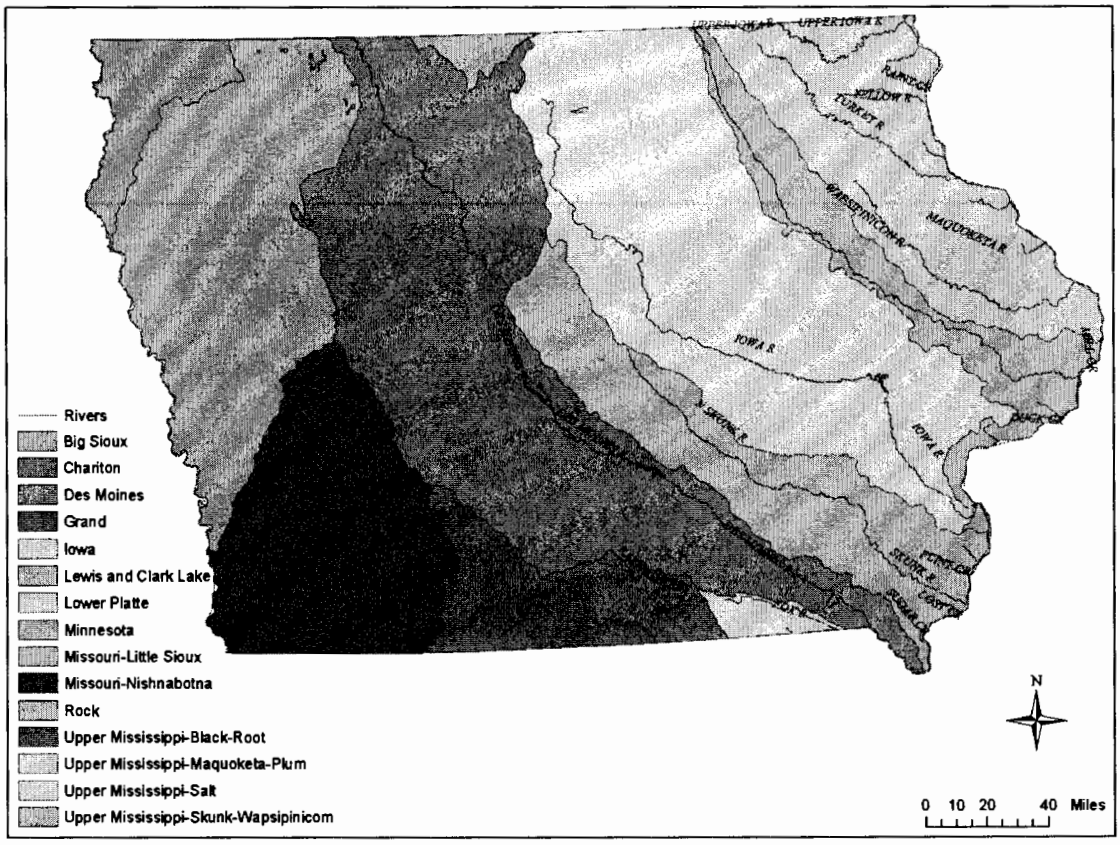

Figure 11. Location of Major (HUC 6) River Basins in Iowa.

Table 2. Summary of Spatial Coverage of Sampling Site by Major River[1] Basin in Iowa.

River Basin/HUC Name	HUC 6 Code	Area		Sampling Sites	
		Hectares	Percent	Number	Percent
Big Sioux	101702	357579.3	2.5	17	2.4
Chariton	102802	239293.7	1.6	26	3.7
Des Moines	71000	3323699.8	22.8	169	23.8
Grand	102801	453617.2	3.1	16	2.3
Iowa	70802	3003668.8	20.6	145	20.5
Lewis and Clark Lake	101701	262.5	0.0	0	0.0
Lower Platte	102002	13.8	0.0	0	0.0
Minnesota	70200	86488.7	0.6	0	0.0
Missouri-Little Sioux	102300	1975907.0	13.6	87	12.3
Missouri-Nishnabotna	102400	1459332.2	10.0	41	5.8
Rock	70900	3.3	0.0	0	0.0
Upper Mississippi-Black-Root	70400	65.9	0.0	0	0.0
Upper Mississippi-Maquoketa-Plum	70600	1463881.1	10.0	95	13.4
Upper Mississippi-Salt	71100	111119.0	0.8	0	0.0
Upper Mississippi-Skunk-Wapsipinicom	70801	2099090.4	14.4	113	15.9
Totals		**14574022.7**	**100.0**	**709**	**100.1**

[1] Major river basins are defined in this report as USGS 6-digit hydrologic cataloging unit (HUC) watersheds.

The results of this analysis indicate that most 8-digit HUC watersheds (91%) contain at least one monitoring station. Furthermore, those 8-digit HUCs lacking monitoring stations are trans-border watersheds where the portion of the watershed lying in Iowa is relatively small in size. The four most significant 8-digit HUC watersheds in Iowa lacking routine monitoring are the Blue Earth, Nishnabotna, Lower Grand, and North Fabius. The 8-digit HUCs with the largest number of monitoring stations are the Little Sioux, Middle Des Moines, Lake Red Rock, Middle Cedar, and Turkey. The analysis of 12-digit HUC monitoring coverage reveals a far different level of coverage compared to that attained at the 8-digit HUC level with 72% of 12-digit HUC watersheds lacking monitoring altogether.

Sampling sites on 303(d) listed waters were also identified to determine whether a correlation exists between sampling and listing locations. Since many of the latitude and longitude locations for sampling stations were not the product of licensed surveying, some minor errors in referenced locations were possible. Therefore, a 0.5 mile buffer was used in connection with sample station locations when determining number of stations located on listed waters. Designated beneficial uses have been established by IDNR for approximately 12,186 miles of the 71,665 miles of rivers and streams in Iowa (17%) (IDNR 2001); of the river mileage with designated beneficial uses,

6,390 miles of rivers and streams were assessed for support of uses in the 2000 305(b) report (52%). Of the mileage of rivers and streams assessed for support of uses, 29.8% were classified as "impaired" (either not supporting or only partially supporting designated beneficial uses) (IDNR 2001). Figure 12 shows the location of the 303(d) listed streams and the sampling locations on those streams.

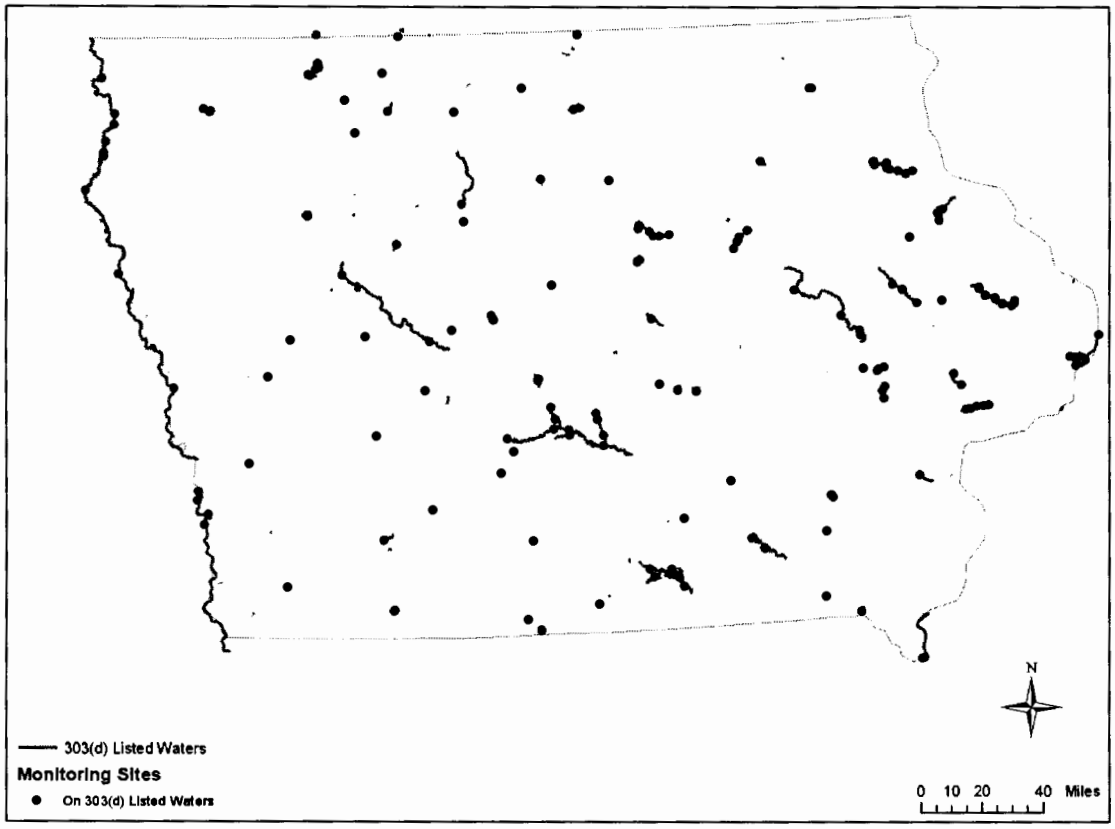

Figure 12. Locations of 1998 Section 303(d) Listed Waters in Iowa and All Monitoring Sites with Location Data (1998-2003) that are Located on Listed Waters.

Parameters sampled and frequency of sample collection were also examined qualitatively for adequacy relative to supporting listing decisions for Iowa waterbodies. Both parameters sampled and frequency of sampling varied in accordance with the sampling program and type of sampling being performed and this variation prevented derivation of "average" frequency of sampling and "primary" samples collected. As an example, a range of chemical, physical, bacteriological, and toxicity testing is performed monthly as part of IDNR's fixed station monitoring and USGS NAWQA program on rivers and streams, whereas the ISU/IDNR Lake Project targets monitoring of trophic state, nutrients, and chlorophyll 3 times per year.

3. IDENTIFICATION OF WATER QUALITY-LIMITED WATERS

In accordance with Section 305(b) of the federal CWA, the IDNR conducts assessments of state water quality monitoring data to determine whether beneficial uses are being achieved for state waterbodies and submits a report to the EPA containing the results of that assessment. This comparison of water quality data to designated beneficial uses and associated criteria then forms the basis for the addition of waters assessed as not fully attaining beneficial uses (i.e. impaired waterbodies) to the State's Section 303(d) list. An "impaired" determination is based upon a waterbody not meeting WQS, which could include designated uses, numeric criteria, narrative criteria, and/or anti-degradation requirements as defined in 40 CFR 131 (IDNR, 2002) and the Iowa WQS [Iowa Administrative Code Chapter 567-61].

In 2000, the Iowa General Assembly enacted "credible data" legislation defining what data may be used in making listing decisions. Refer to section 4.7. of this report for further discussion on Iowa's "credible data" legislation.

3.1. Iowa's Beneficial Water Uses

Four classes of beneficial uses have been designated for surface waters in Iowa in the Iowa WQS (IAC 1990, 1996).

1. Class A: Waters designated for primary contact recreational uses (i.e. swimming, water skiing).

2. Class B: Waters designated for wildlife, fish, aquatic and semiaquatic life and secondary contact recreational uses. Class B waters are subdivided into the following categories:

> **Class B(LR)(limited resource warmwater)**: Streams in which flow or other physical characteristics limit the ability of the waterbody to maintain a balanced warmwater community. Such waters support only populations composed of species adaptable to a wide range of physical and chemical conditions, and are not generally harvested for human consumption.
>
> **Class B(WW)(significant resource warmwater)**: Lakes or rivers in which temperature, flow and other habitat characteristics are suitable for the maintenance of a wide variety of reproducing populations of warmwater game fish and associated aquatic communities, including sensitive species.
>
> **Class B(CW)(coldwater aquatic life)**: Streams or lakes in which the temperature, flow, and other habitat characteristics are suitable for the maintenance of a wide variety of coldwater species, including nonreproducing populations of trout and associated aquatic communities.

Class B(LW)(lakes and wetlands): Artificial impoundments and natural lakes with hydraulic retention times and other physical and chemical characteristics suitable to maintain a balanced community normally associated with lake-like conditions.

3. Class C: Rivers or lakes that are designated as a raw source of potable water.

4. General Uses: All surface waters potentially used for livestock and wildlife watering, aquatic life, noncontact recreation, crop irrigation, and industrial, domestic, agricultural, and other incidental water withdrawal uses not protected by Class A, B, or C water quality criteria.

In addition to the foregoing categories, Iowa surface waters may also be identified as either **High Quality (HQ)** or **High Quality Resource (HQR)**. High Quality waters are those waters with exceptionally better quality than specified by Iowa water quality criteria and with exceptional recreational and ecological importance. High Quality Resource waters are those waters of substantial or ecological significance which possess unusual, outstanding or unique physical, chemical, or biological characteristics which enhance the beneficial uses and warrant special protection.

3.2. IDNR'S 2002 303(d) Listing Process

The first step in IDNR's process for determining whether designated beneficial uses or general uses have been impaired in classified water bodies is to determine whether data of sufficient quantity and quality are available for assessment purposes (IDNR 2002). In accordance with Iowa's credible data law, this includes a determination of whether data have been collected from those sites within the last 5 years (Iowa's credible data law dictates that data greater than 5 years old generally can not be used for listing purposes.) Following this data assessment, waters are classified as either fully supporting, fully supporting/threatened, partially supporting, or not supporting based upon level of use support. Waterbodies determined to be partially supporting, not supporting, or fully supporting/threatened with a declining water quality trend are candidates for listing under section 303(d) (IDNR 2002). Waterbodies with all classified uses assessed as either "fully supporting" or "fully supporting/threatened" are identified as attaining CWA goals (IDNR 2001).

3.2.1. Data Used for Listing

Based on guidance for Section 305(b) reporting provided to states by EPA, IDNR subdivides water quality data collected for assessment purposes into two types (EPA 1997). **Evaluated assessments** are based upon water quality information other than current quantitative site-specific data and includes assessments based on results of only a few grab samples and "best professional judgement". **Monitored assessments** are based on current data, defined as five years old or less, that is site-specific and believed to accurately represent water quality conditions. Subdivision of assessment data into these two categories commonly comes down to the quantity of data available. Thus, use support decisions based on "evaluated assessments" tend to have lower confidence than those based on "monitored assessments". To comply with

requirements of Iowa's credible data law, IDNR only uses "monitored assessments" for purposes of section 303(d) listing (IDNR 2002).

Data adequacy (quantity) issues are addressed by "data completeness" guidelines developed by IDNR to avoid basing water quality assessments on inadequate amounts of water quality data and to reduce errors in assessments. The current version of IDNR's Section 305(b) data completeness guidelines is presented in Table 3.

Table 3. Data completeness guidelines for using results of routine ambient monitoring to make "monitored" assessments of beneficial uses (IDNR 2002).

DESIGNATED BENEFICIAL USE	TYPE OF INFORMATION	DATA REQUIRED
Aquatic Life	Data for levels of toxics in waterbodies designated for "fishable" (Class B) uses or classified for general uses.	Data collected quarterly or more frequently during the 3 most recent complete federal fiscal years (minimum of 10 samples).
	Data for levels of conventional pollutants (DO, pH, temp.) In waterbodies designated for "fishable" (Class B) uses or classified for general uses.	Data collected monthly or more frequently during one or both years of the current biennial period (minimum of 10 samples).
	Data from IDNR biocriteria sampling at reference, test, and watershed sites.	Assessments conducted during the 5 most recent complete calendar years.
	Results of fish kill investigations.	Reports of pollutant-caused fish kills from the 5 most recent complete calendar years.
Fish Consumption	Data for levels of toxic contaminants in fish tissue in waterbodies designated for "fishable" (Class B) or classified for general uses.	All data on levels of toxic contaminants in fish tissue collected over the 5 most recent complete calendar years.
Primary Contact Recreation	Data for levels of fecal coliform bacteria from river waterbodies or non-beach areas of publicly-owned lakes and flood control reservoirs designated for swimmable (Class A) uses.	Data collected monthly or more frequently during April-October periods of the current biennial period; at least 10 samples need to be collected at flows not materially affected by surface runoff.
	Data for levels of fecal coliform bacteria from beach areas of publicly-owned lakes and flood control reservoirs.	At least five samples approximately equally spaced over a 30-day period during April-October periods of the current biennial period.
Drinking Water	Data for levels of toxics from waterbodies designated for drinking water (Class C) uses.	Data collected quarterly or more frequently during the 3 most recent complete federal fiscal years (minimum of 10 samples).
	Data for levels of nitrate from waterbodies designated for drinking water (Class C) uses.	Data collected monthly or more frequently during the current biennial period (minimum of 10 samples).

3.2.2. Assessment of Compliance with WQS

The status of Iowa's waterbodies is determined by their compliance with state WQS. Iowa's WQS list the uses for which classified streams and lakes are protected and the maximum concentrations of chemicals and bacteria allowable in those waters. All surface waters of the state are protected by narrative standards for aquatic life, livestock and wildlife watering, noncontact recreation, crop irrigation, and industrial, domestic, agricultural, and other incidental water withdrawal uses (IDNR 2001). Parameters monitored by IDNR for purposes of section 303(d) listing and standards for assessing attainment of the four classes of beneficial designated uses are outlined in Table 4. Methods for assessing the level of use support for the various designated beneficial uses are outlined in Tables 5a, 5b, and 5c.

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Table 4. Summary of Iowa water quality criteria used to make assessments of support of beneficial designated uses of Iowa surface waters for purposes of Section 303(d) listing (IDNR 2002). The criteria are only for those parameters monitored in Iowa surface waters as part of the IDNR ambient monitoring network.

	DESIGNATED USE					
PARAMETER	**Class A: swimmable**	**Class B(WW): significant resource aquatic life**	**Class B(LR): limited resource aquatic life**	**Class B(CW): coldwater aquatic life**	**Class B(LW): aquatic life of lakes and wetlands**	**Class C: source of a water supply**
dissolved oxygen (mg/l) (24-hour minimum / 16-hour minimum)	none	5.0	5.0	7.0	5.0	none
temperature (added heat)	none	no increase > 3 C; increase < 1 C/hr; no increase above 32 C	no increase > 3 C; increase < 1 C/hr; no increase above 32 C	no increase > 2 C; increase < 1 C/hr; no increase above 20 C	no increase > 2 C; increase < 1 C/hr; no increase above 20 C	none
pH	not < 6.5; not > 9; max. change = 0.5 units	not < 6.5; not > 9; max. change = 0.5 units	not < 6.5; not > 9; max. change = 0.5 units	not < 6.5; not > 9; max. change = 0.5 units	not < 6.5; not > 9; max. change = 0.5 units	none
ammonia-nitrogen (mg/l)	none	criteria are dependent on the pH and temperature of the lake, stream or river; see Tables 3a through 3c of the *Iowa Water Quality Standards* (IAC 1990) for criteria for Class B(CW), B(WW), B(LW) and B(LR) waters.				
nitrate-nitrogen (mg/l)	none	none	none	none	none	MCL: 10

chloride (mg/l)	none	none	none	none	none	MCL: 250
fluoride (mg/l)	none	none	none	none	none	MCL: 4,000
fecal coliform bacteria	Apr.-Oct. ≤200 org./100ml when not materially affected by surface runoff	none	none	none	none	none
PARAMETER	**Class A: swimmable**	**Class B(WW): significant resource aquatic life**	**Class B(LR): limited resource aquatic life**	**Class B(CW): coldwater aquatic life**	**Class B(LW): aquatic life of lakes and wetlands**	**Class C: source of a water supply**
TOXIC METALS (all values in µg/l; chronic/ acute/ human health criteria (HHC) are given; NA = value not applicable)						
arsenic	none	200 / 360 / NA	1000 / 1800 / NA	200 / 360 / NA	200 / 360 / NA	HHC: 018
cadmium	none	15 / 75 / 168	25 / 100 / NA	1 / 4 / 168	1 / 4 / 168	MCL: 5
chromium	none	40 / 60 / 3365	200 / 300 / NA	40 / 60 / 3365	10 / 15 / 3365	MCL: 100
copper	none	35 / 60 / 1000	55 / 90 / NA	20 / 30 / 1000	10 / 20 / 1000	HHC: 1300
cyanide	none	10 / 45 / NA	10 / 45 / NA	5 / 20 / NA	10 / 45 / NA	HHC: 700
lead	none	30 / 200 / NA	80 / 750 / NA	3 / 80 / NA	3 / 80 / NA	MCL: 50
mercury	none	2.1 / 4.0 / 0.15	3.7 / 6.9	3.5 / 6.5 / 0.15	0.91 / 1.7 / 0.15	HHC: 0.05
zinc	none	450 / 500 / 5000	2000 / 2200 / NA	200 / 220 / 5000	100 / 110 / 5000	HHC: 9100
PESTICIDES (all values in µg/l; chronic / acute / human health criteria (HHC) are given; NA = value not applicable)						

2,4 D	none	none	none	none	none	HHC: 100
2,4,5-TP (Silvex)	none	none	none	none	none	HHC: 10
alachlor	none	none	none	none	none	MCL: 2
atrazine	none	none	none	none	none	MCL: 3
carbofuran	none	none	none	none	none	MCL: 40
chloropyrifos	none	0.041 / 0.083 / NA	0.041 / 0.083/ NA	0.041 / 0.083 / NA	0.041 / 0.083 / NA	none
DDT+DDD+DDE	none	0.001 / 0.8 / 0.0059	0.029/ 0.95/ NA	0.001 / 0.8 / 0.0059	0.001 / 0.8 / 0.0059	HHC: 0.0059
dieldrin	none	0.056 / 0.24 / 0.0014	0.056/ 0.24/ NA	0.056 / 0.24 / 0.0014	0.056 / 0.24 / 0.0014	HHC: 0.0014
dinoseb	none	none	none	none	none	MCL: 7
lindane	none	NA / 0.95 / 0.63	NA / 0.95 / 0.63	NA / 0.95 / 0.63	NA / 0.95 / 0.63	HHC: 0.19
PARAMETER	**Class A: swimmable**	**Class B(WW): significant resource aquatic life**	**Class B(LR): limited resource aquatic life**	**Class B(CW): coldwater aquatic life**	**Class B(LW): aquatic life of lakes and wetlands**	**Class C: source of a water supply**
parathion	none	0.13 / 0.65 / NA	0.13 / 0.65 / NA	0.13 / 0.65 / NA	0.13 / 0.65 / NA	none
picloram	none	none	none	none	none	MCL: 500
simazine	none	none	none	none	none	MCL: 4

Tables 5a, 5b, and 5c. Methods for determining support of classified beneficial uses for Aquatic Life, Fish Consumption, Primary Contact Recreation, and Drinking Water for surface waters in Iowa (IDNR 2002).

Table 5a.

AQUATIC LIFE USES					
		Beneficial Use "Fully Supported"		Beneficial Use "Impaired"	
Type of Waterbody	**Source of Information**	**Fully Supported**	**Fully Supported/ Threatened**	**Partially Supporting**	**Not Supporting**
Rivers, streams, lakes & flood control reservoirs	Data from ambient water quality monitoring during current biennial period	No violations of acute or chronic toxicity criteria in grab samples, criteria for conventional pollutants exceeded in ≤ 10% of samples	Up to one violation of acute or chronic toxicity criteria if grab samples are collected quarterly or more frequently	Criteria for conventional pollutants exceeded in 11-25% of samples	> one violation of acute / chronic criteria if samples collected quarterly or more often; criteria for conventionals exceeded in > 25% of samples.
Warmwater Streams and Rivers	Stream biocriteria sampling data	Scores for both fish and macroinvertebrates indexes of biotic integrity significantly greater than the ecoregion / subecoregion biological impairment criterion	Scores for both fish and macroinvertebrates indexes of biotic integrity approximately equal to the ecoregion / subecoregion biological impairment criterion	Scores for one of indexes of biotic integrity (fish or macroinvertebrates) significantly less than the ecoregion / subecoregion biological impairment criterion	Scores for both indexes of biotic integrity (fish and macroinvertebrates) significantly less than the ecoregion / subecoregion biological impairment criterion

Coldwater Streams	Stream biocriteria sampling data	Two or less of the eight biological indicators less than the 25th percentile of the respective indicator value for Iowa coldwater streams	From two to four of the eight biological indicators less than the 25th percentile of the respective indicator value for Iowa coldwater streams	From five to six of the eight biological indicators less than the 25th percentile of the respective indicator value for Iowa coldwater streams	From seven to eight of the eight biological indicators less than the 25th percentile of the respective indicator value for Iowa coldwater streams
Rivers, streams, lakes & flood control reservoirs	Fish kill reports	No pollutant-caused fish kills during the most recent 3-year period	[category not used]	One pollutant-caused fish kill during the most recent 3-year period	More than one pollutant-caused fish kill during the most recent 3-year period

Table 5b.

FISH CONSUMPTION USES					
		Beneficial Use Fully Supported		**Beneficial Use Impaired**	
Type of Waterbody	**Source of Information**	**Fully Supported**	**Fully Supported/ Threatened**	**Partially Supporting**	**Not Supporting**
Streams, rivers, lakes, & flood control reservoirs	monitoring of levels of toxic contaminants in fish tissue	Levels of all toxics less than one-half the respective FDA action levels; waterbody is not covered by a fish consumption advisory	Level of at least one toxic is greater than one-half the respective FDA action level; waterbody is not covered by a fish consumption advisory	[category is not part of IDNR's consumption advisory protocol and is not used for listing purposes]	Levels of one or more toxics have exceeded respective FDA action levels in two consecutive samplings and a "no fish consumption" advisory is in effect for the general population
PRIMARY CONTACT RECREATION (SWIMMABLE) USES					
Streams, rivers, lakes, & flood control reservoirs	monthly monitoring data for fecal coliform bacteria	Geometric mean of fecal coliform samples ≤ 200 orgs/ 100 ml and ≤ 10% of samples > 400 orgs/ 100 ml.	[category not used]	Geometric mean of fecal coliform samples ≤ 200 orgs/ 100 ml but > 10% of samples > 400 orgs/ 100 ml.	Geometric mean of fecal coliform samples > 200 orgs/ 100 ml.

Lake beaches	weekly monitoring data for fecal coliform bacteria	Geometric mean of at least 5 fecal coliform samples over a 30-day period ≤ 200 orgs/ 100 ml.	[category not used]	[category not used]	Geometric mean of at least 5 fecal coliform samples over a 30-day period ≥ 200 orgs/ 100 ml.
Streams, rivers, lakes, & flood control reservoirs	closure of beaches and other swimming areas	No swimming area closures in effect during the biennial reporting period.	[category not used]	One swimming area closure of less than one week duration during the biennial reporting period.	More than one swimming area closure, or one swimming area closure of more than one week duration during the biennial period.

Table 5c.

DRINKING WATER USES					
		Beneficial Use Fully Supported		**Beneficial Use Impaired**	
Type of Waterbody	**Source of Information**	**Fully Supported**	**Fully Supported/ Threatened**	**Partially Supporting**	**Not Supporting**
Waterbodies designated for use as a source of potable water (=raw water source)	ambient monitoring data for toxics	All levels of toxic metals or pesticides are less than human health criteria (HHC) or maximum contaminant levels (MCLs)	Average levels of toxic metals or pesticides ≤ HHC or MCL, but one or more samples > MCL.	[category not used]	Average level of toxic metals or pesticides greater than MCL.
Waterbodies designated for use as a source of potable water (=raw water source)	ambient monitoring data for nitrate	All levels of nitrate are less than U.S. EPA's maximum contaminant levels (MCLs).	No more than 15% of samples violate the MCL for nitrate. Or, trend analysis shows a significant increase in contaminant levels.* * Considered as candidates for Section 303(d) listing.	From 15-25% of samples violate the MCL for nitrate and/or from 15-25% of samples violated the MCL for nitrate in the previous biennial reporting period.	More than 25% of samples exceed the MCL for nitrate and/or more than 25% of samples violated the MCL for nitrate in the previous biennial reporting period.
Municipal drinking water (=finished water)	public water supplies using surface waters	No drinking water supply closures or advisories in effect; water not treated beyond reasonable levels.	Some drinking water use restrictions have occurred and/or the potential for adverse impacts to source water quality exist.	One drinking water advisory lasting 30 days or less per year, or other problems not requiring closure but affecting treatment costs.	One or more drinking water supply advisory lasting more than 30 days per year, or one or more drinking water supply closures per year.

3.2.3. Organization of the 2002 303(d) List

Iowa's 303(d) list of impaired waterbodies is subdivided into five categories. These categories are as follows (IDNR 2002):

Part One: Waterbodies impaired by one or more "pollutant" for which TMDLs would be required to be established within 13 years. A "pollutant", as defined in 40 CFR Section 130.2, could be any of the following: dredged soil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt; also, sediments, pathogens, nutrients, metals, low dissolved oxygen, temperature, pH, pesticides, mercury, organics, ammonia, and industrial, municipal, and agricultural waste discharged into water.

Part Two: Waterbodies impaired by "pollution" but not impaired by one or more "pollutants" and which will not require a TMDL. "Pollution" is defined in 40 CFR Section 130.2 as "the man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of the water." Examples of "pollution" include habitat alterations, impaired biological communities and flow alterations.

Part Three: Impaired waterbodies for which TMDLs have been established but where WQS have not yet been attained.

Part Four: Impaired waterbodies for which the state can demonstrate that technology-based or other enforceable controls would attain WQS by the next listing cycle. Generally, TMDLs would not be required for waterbodies included in Part Four of the list; however, such waterbodies that do not achieve WQS by the next listing period could potentially be moved to Part One and a TMDL required. IDNR does not currently list any sites in Part Four, however, due to conflicts with Iowa's credible data law, which specifically bars the listing of waters where applicable WQS can be attained by existing technology-based effluent limits or other required pollution control measures.

Part Five: Waterbodies that are biologically impaired, but where no source or cause of impairment has been identified. Biological impairment is typically identified through biological monitoring of streams and rivers and through standardized assessments of lake recreational fisheries. Depending upon consistency with Iowa's "credible data" law, other types of biological monitoring may result in identification of a biological impairment without identifying a cause of the impairment. Identification of the cause(s) of impairment will precede movement of these waters to Parts One and Two of the list. Additional data collection and analysis is performed prior to the next reporting cycle to attempt to determine the cause of such impairments.

A 9-year schedule has been established for completing TMDL development for the 157 waterbodies listed on Iowa's 1998 Section 303(d) list (*SAILORS, Inc. et al. vs. the EPA et al., 2001*). Table 7 presents a listing of the number of impaired waterbodies or waterbody segments requiring TMDL development each year of the 9 year period.

Table 6. TMDL Completion Schedule for Waters on Iowa's 1998 Section 303(d) List

Deadline	Number of waterbodies or segments requiring TMDLs
December 15, 2000	3 (specific waterbodies identified)
December 15, 2001	12 (specific waterbodies identified)
December 15, 2002	13 (specific waterbodies identified)
December 15, 2003	16
December 15, 2004	22
December 15, 2005	19
December 15, 2006	17
December 15, 2007	17
December 15, 2008	18
December 15, 2009	20

3.2.4. Prioritization Criteria

In addition to requiring a listing of impaired waters, Section 303(d) of the CWA also requires the establishment of a priority ranking system for those waters, which takes into account the severity of the pollution and the uses to be made of such waters. IDNR's prioritization is based on these required considerations as well as other factors, such as best professional judgement of IDNR staff, results of volunteer monitoring, and public comments. Meeting any one criterion in a priority category does not necessarily mean that the waterbody will be prioritized as such, since many waters fit criteria from multiple categories (IDNR 2002).

High Priority

- Waters where sufficient water quality information exists to understand and analyze causes and effects of the problems and opportunities are available to correct or substantially improve water quality;
- Waters with imminent human health or aquatic health problems;
- Waters with documented widespread local support for water quality improvement; or
- Waters where state or federally threatened or endangered species are impacted.

Medium Priority

- Waters where sufficient water quality information exists to understand and analyze causes and effects of the problems; however, opportunities are not immediately available to correct or substantially improve water quality; or
- Waters where local support for TMDL development is expected but not known.

Low Priority

- Waters where insufficient water quality information exists to understand and analyze causes and effects of the problems and limited opportunities are available, at this time, to correct or substantially improve water quality;
- Waters with no evident local support for water quality improvements.

4. SURFACE WATER MONITORING AND CWA SECTION 303(D) LISTING RECOMMENDATIONS

4.1. Monitoring Program Structure, Funding and Staffing

The major objectives of Iowa's surface water quality monitoring program are outlined in the body of the most recent Section 305(b) Report (IDNR 2001) and within a document entitled *Iowa Water Monitoring Plan 2000* (IDNR 2000) and are summarized in section 2.1 of this report. The monitoring objectives outlined in these documents range from resource characterization and protection to abatement and restoration of impaired waters and, thus, are appropriately comprehensive in scope for a state monitoring program and consistent with EPA Region 7's guiding principles for such a program. Current objectives and priorities for improving the monitoring program were partly formulated in 1999 and 2000 through a broad public participation process that featured the involvement of two groups: a Water Monitoring Advisory Task Force, composed largely of public stakeholders, and a Technical Advisory Committee, composed of professionals with backgrounds in monitoring. One of the results of this collaborative effort was *Iowa Water Monitoring Plan 2000* (IDNR 2000) which identifies areas in the monitoring program that should receive prioritization for future funding and outlines funding levels needed to enact priority recommendations. A shortcoming of this document is that it lacks a clearly articulated schedule for requesting funding and enacting program recommendations.

In addition to the data derived from their own monitoring activities, IDNR makes effective use of data collected by other agencies and organizations, which include the USGS, USACE, EPA and neighboring state environmental agencies. IDNR also uses data collected by municipalities, industry, volunteers and data collected as part of special projects. Verification that data provided by cooperating institutions were collected in accordance with a scientifically defensible sampling and analysis plan and appropriate QA/QC procedures is required before that data can be used for listing purposes, as specified in Iowa's Credible Data Law. IDNR has attempted to take these

diverse monitoring networks into account in the design of their fixed station network to avoid duplication of effort. Coordination of sampling efforts between the different monitoring programs is also one of the mandates to the Water Monitoring Advisory Task Force.

According to IDNR, due to the requirements of Iowa's Credible Data Law, some volunteer monitoring conducted in the state of Iowa is not considered sufficiently "credible" to be used for listing purposes. Volunteer data, according to IDNR, must be supported by an IDNR-approved sampling and analysis plan and include appropriate QA/QC procedures. Identified by IDNR as another limitation on volunteer collected data is the existence of unexplained and presumably nonrepresentative variations in water quality data reported by volunteers. Upgrades in the training offered to Iowa volunteers are currently under consideration by IDNR and Level I training for volunteers has been expanded. Improved QA/QC procedures resulting from such training will likely reduce observed variations in volunteer-collected data. Use of volunteer data by some other states for quantitative assessments demonstrate that such sample collection problems are not insurmountable.

IDNR is currently receiving 2.9 million dollars from the state to fund the water monitoring program. This funding level represents a substantial increase over that provided prior to 2000 and has allowed IDNR to upgrade the level of monitoring being performed in the state. However, this annual funding level is still far short of the 6 to 8 million dollars that IDNR independently estimated was needed. Yearly increases in funding that are targeted toward addressing the needs identified in the *Iowa Water Monitoring Plan 2000* (IDNR 2000) would lessen the funding disparity. While the Iowa state legislature has increased funding for the ambient surface and groundwater monitoring programs in the last few years, these increases have, to some extent, been offset by budget cuts to other agencies and programs.

Staffing for the water monitoring program (4 FTE) is currently funded through CWA Section 106 grants from the EPA, since state appropriated monitoring funds are prohibited from being used for department personnel. Staffing limitations have partly been addressed by the partnering of staff from the Water Monitoring Section of the Iowa Geological Survey Bureau (IGSB) with existing IDNR water quality staff to form a more functional and effective water monitoring and assessment group.

4.2. Data Management, Analysis, and Reporting

IDNR currently stores water quality data from their ambient monitoring program in an updated version of the Iowa STORET database system and annually uploads that data to the EPA's STORET system. Data stored in the Iowa system is internet-accessible, which allows the public to have access to the data. This approach to data management for the ambient water quality data is entirely consistent with EPA recommendations. However, the current data management approach only enters IDNR-generated ambient data into EPA STORET, while other data from various cooperating agencies that is used for making use support determinations is managed separately, typically in isolated Excel files. (USGS data is internet accessible on the NWISweb.) The lack of a consistent and comprehensive approach to data management complicates data

analysis when making resource assessments and use support judgements. For the ambient monitoring data that is managed in Iowa STORET, retrieval of large volumes of data, complex queries, or repeated retrievals can be cumbersome, especially to novice users.

To date, data analysis has been a lesser priority relative to actual production of data and managing of that data in a form accessible to the public. The need for the EPA to restore data analysis capabilities to the EPA STORET system is becoming critical as the state attempts to deal with issues such as nutrient criteria, TMDL development, and the emphasis on numeric WQS. As the volume of volunteer monitoring data continues to increase, public pressure to incorporate that data into statewide assessments of water quality will also increase.

Database tools for organizing, plotting, querying, etc. are needed by the TMDL program and other programs. These tools should feed smoothly into statistical analysis packages, GIS layers, and models. The tools should be able to acquire data directly from EPA and Iowa STORET. Various scales of land use and land cover data in GIS coverages will be needed for watershed level and statewide analyses for a variety of issues. NRCS development of Iowa SSURGO soils information is needed for dependable watershed modeling and as an aid to the TMDL program. Valuable IDNR resources are and will be used to convert existing county soil maps into SSURGO-like information for modeling. Additionally, digitized FSA and land use cropping practice info would be beneficial for watershed analysis.

Plans and methods are currently evolving to address some of these data management issues. To allow better management and access to all monitoring data, IDNR is working toward implementing direct data entry into Iowa STORET for cooperating agencies and programs (IDNR 2000). This process of consolidating monitoring data should continue and be expanded. IDNR should continue to develop data retrieval applications and web-based data management tools. A data warehousing structure should be developed to facilitate faster data retrieval and saving queries.

EPA's Office of Water is encouraging states and cooperating agencies to georeference all waterbody information with the National Hydrography Dataset (NHD) or, where NHD georeferencing is not possible, to provide waterbody latitude and longitude. Georeferencing Iowa waterbodies to NHD would facilitate data management.

4.3. Spatial Coverage of Sampling

As was previously detailed in Section 2.2.4, the GIS analysis of the spatial coverage of Iowa's surface water quality monitoring program indicates that sample distribution is reasonably proportionate to the relative size of the watershed, at the major basin level (see Table 2 on page 19 of this report). Reasonable spatial coverage also appears to have been attained at the 8-digit HUC watershed level (see Figure 9 on page 16 of this report).

Review of sample distribution relative to listed waters shows a similar proportionate relationship, with 32% of all sampling sites being found on listed waters, while listed waters comprise 29.8% of all waters assessed. This proportionate relationship shows a general lack of bias in the selection of sampling sites in Iowa.

The foregoing relationships indicate that Iowa's monitoring strategy and network design have been well thought out and designed to maximize coverage given obvious program funding constraints. This effective utilization of available funds is weighed against the number of beneficial-use waterbodies that are not currently assessed, as described in the following paragraphs.

Iowa has 47,603 acres of publicly-owned lakes designated for beneficial uses. Iowa has 40,850 acres of flood control reservoirs designated for beneficial uses (IDNR 2001). From an acreage perspective, 90% of publicly-owned lakes and 100% of reservoirs are regularly assessed for support of beneficial uses. 52% of Iowa's 12,186 miles of rivers and streams which are designated for beneficial use are routinely assessed (IDNR 2001). The foregoing statistics are comparisons between mileage (rivers) and acreage (lakes). By comparing actual numbers of waterbodies, a more accurate percentage of beneficial-use waters being assessed emerges. Note the following:

- With regard to rivers, 37% of river and stream waterbodies designated for beneficial uses are currently assessed (392 out of 1,068)
- With regard to lakes, 49% of lake waterbodies designated for beneficial uses are currently assessed (136 out of 279)(IDNR, 2001).

To gain an insight of Iowa's wetlands, Iowa reported 27,273 acres of wetlands with designated beneficial uses (out of 50,271 total acres) (IDNR 2001). Prior to 2000, 57% of the 34,330 wetland acres that were assessed were further classified as impaired (IDNR 2001).

Table 7. Estimated Total Size of Waterbodies in Iowa, with Size Designated for Beneficial Use and Size Actually Assessed (IDNR 2001). Values in parentheses represent number of specified waterbodies.

Waterbody Type	Estimated Total Size in State	Size Designated for Beneficial Use	Size Assessed for Support of Use
Rivers/streams (miles)	71,665	12,186 (1,068)	6,390 (392)
Publicly-owned Lakes (acres)	92,816	47,603 (279)	43,268 (136)
Flood Control Reservoirs (acres)	40,850 (4)	40,850 (4)	40,850 (4)
Publicly-owned Wetlands (acres)	50,271	27,273 (88)	-

Improvements necessary to adequately assess state lakes and wetlands are specifically discussed and addressed in a later section of this report. With regard to the assessment of rivers and streams, the relatively low percentage of those river and stream segments with designated uses being routinely assessed is a significant issue in Iowa's monitoring program. IDNR's recent initiation of a four-year probabilistic survey of the state's stream resources will likely help with the assessment of general water quality within the ecoregions and will facilitate identification of areas of impairment. Sampling frequency remains an important issue for listing purposes. While any significant effort to improve sampling will require additional state resources, a cost-effective approach could be the development of a well-designed rotating basin sampling program. A rotating basin approach would provide a hydrologic framework to focus resources on specific basins while allowing comprehensive assessment of all watersheds or basins over a 3-5 year period. The cyclic monitoring process would also facilitate trend analysis and assessment of implemented management strategies, and additionally, IDNR would be able to retain current fixed monitoring stations with historic data sets.

Another area of consideration is Iowa's spatial coverage at the smaller watershed scales (see Figure 10 on page 17 of this report). Although significant improvements in this aspect of the monitoring program is likely beyond the funding ability of an IDNR-directed project, it could be the subject of a volunteer monitoring program initiative.

4.4. Sampling Parameters (Core and Supplemental Water Quality Indicators)

Because of the funding limitations imposed on most state monitoring programs, EPA recommends use of a tiered sampling approach that would maximize parameter coverage and would include a core set of baseline indicators to represent each applicable designated use, plus supplemental indicators that would be selected according to site-specific or project-specific decision criteria (EPA 2003). Parameters targeted for sampling in Iowa waterbodies varies by waterbody type and sampling program and, in most cases, appear to be appropriately designed to reflect differences in designated beneficial use. This sampling approach is generally consistent with EPA's recommendation for the establishment of core water quality indicators.

One exception to the foregoing characterization that IDNR's sampling parameters adequately characterize designated beneficial uses involves aquatic life criteria. In some cases, parameters used to make use support determinations for aquatic life do not appear to be sufficiently comprehensive to allow a thorough determination to be made. Specifically, organic enrichment, nutrients, and siltation have been identified as the most commonly identified causes of water quality impairments in Iowa, with phosphorus being specifically singled out as the most common nutrient controlling plant growth (IDNR 2001). While data on dissolved orthophosphate as phosphorous and total phosphorus are routinely collected by IDNR, this data is not currently used for assessing use support; likely, in large part, due to a lack of state criteria for identifying impairment. Trophic state index (TSI), which uses chlorophyll-a, total phosphorus, and Secchi Disk transparency to estimate trophic state, or productivity, in a lake, is currently being used to assess use support in the state's publicly-owned lakes. While this indicator provides some

assessment of nutrient impairment in lakes, it only recognizes general relationships between nutrients and trophic state and, therefore, does not provide a complete substitute for direct numeric nutrient criteria. State criteria are similarly lacking for assessing impairment resulting from siltation and such assessments are further complicated by a lack of adequate sampling parameters for measuring siltation. To address these deficiencies, IDNR could reevaluate its assessment protocols and standards for nutrients and siltation in light of EPA's recent recommendations in this area (EPA 2000).

Other parameters that would be desirable additions to IDNR's surface water monitoring program, as resources become available, include the following:

- Fish tissue at the current urban stream locations, plus some additional urban locations;
- Metals at all the ambient sites (quarterly) to make Aquatic Life Use Support decisions;
- Persistent Bioaccumulative Toxics (PBTs) in water, sediment and fish tissue at a subset of all ambient sites; such toxics would include mercury, arsenic, pesticides and their degradates, antibiotics, and Polycyclic Aromatic Hydrocarbons (PAHs) at coal tar sites;
- Periphyton at stream reference sites;
- cyanobacteria, viruses and parasites at public beaches.

While core indicators have been established by IDNR to evaluate use support for all designated beneficial uses, it is unclear whether IDNR is following consistent establishment of supplemental water quality indicators. Additional parameters that appear comparable to such supplemental indicators have been targeted for collection in select situations. One such example is testing for a variety of pharmaceuticals, industrial chemicals, and insecticides being completed at monitoring stations located upstream/downstream of 10 major cities (IDNR 2002). To extend their monitoring capabilities, IDNR may consider establishing a process for identifying supplemental water quality indicators that would be monitored when there is a concern that a specific pollutant may be present in a watershed, when core indicators indicate impairment, or when supporting special studies such as screening for potential pollutants. Since supplemental indicators are particularly useful for identifying causes and sources of impairment, they could help IDNR resolve questions about undefined impairments.

4.5. Temporal Coverage

Monitoring station sampling frequency in Iowa varies somewhat depending on the type of sampling being conducted and the institution or agency performing the sampling. Sampling conducted on Iowa rivers as part of IDNR's ambient monitoring program was recently upgraded to monthly for all 62 sites, as was IDNR's monitoring of stations upstream and downstream of major cities. Much of the data collected by cooperating agencies and groups such as USGS, USACE, Syngenta, Rathbun Lake Watershed Alliance, etc. are also collected on a monthly or greater frequency. State-owned beaches are sampled on a weekly frequency in the summer months. Sampling currently performed as part of the ISU-IDNR Lake Study is collected at a sampling frequency of 3 times per year. Sampling frequency for biocriteria is currently not precisely defined but is intended to be repeated on about a 5 year rotation.

While sample data sets composed of 30 or more samples are typically recommended where statistical tests are used, in order to have good power for detecting exceedences, the sampling frequency employed by IDNR and cooperating agencies for most data collection efforts appear suitable for assessing ambient conditions and, in general, is adequate to define level of use support (EPA 2002). Exceptions to this general statement include the following areas.

Iowa river reaches and the non-beach areas of some lakes designated for primary contact recreational uses are sampled once to twice a month as part of the state's ambient monitoring program. This monitoring frequency fails to produce the amount of data needed to use EPA recommended assessment methodologies (IDNR 2002). IDNR's approach for assessing use support, in these cases where there is not enough data to use the EPA methodology, is to compare the geometric mean of a minimum of 10 samples collected over one or both recreational seasons to the state fecal coliform water quality standard, verification that no more than 10% of samples exceeded an EPA recommended single sample maximum allowable fecal coliform density of 400 organisms per 100 ml, and verification that no swimming area closures were issued during the two-year assessment period. According to IDNR, this approach produces a smaller false positive rate (.30) than would EPA's methodology if used on such a limited data set (IDNR 2002).

With regard to lake beaches, single-sample maximum values are not used by IDNR as part of the criterion for assessing impairment because the standard 10% critical value would be exceeded by one exceedence for data sets of less than 10 samples, which would result in a high probability of incorrectly concluding that an impairment exists (IDNR 2002). This high false positive rate is a direct result of a less than optimal sampling frequency.

Sampling conducted as part of the state's Lake Study has generally yielded sufficient data, to date, for establishing impairment, as a result of satisfying Iowa's 303(d) listing methodology which requires that the combined data from at least three years of monitoring be used to establish impairment from this type of lake study (IDNR 2002b). During the current listing cycle, IDNR has been able to use the TSI approach to identify lakes with evidence of impairment for addition to the Section 303(d) list as well as establish the lack of water quality impairment leading to proposed removal from the list. Should IDNR continue funding support for lake water quality monitoring, the three year data minimum should be met in future listing cycles, which will provide sufficient data to assess impairment using standard data. The sampling strategy employed for this lake study should be reevaluated to ensure that frequency and the restriction of data collection to summer months is sufficient to adequately evaluate seasonal variability and use support. Biocriteria sampling is currently very sporadic but this sampling approach is still in a state of evolution and standard statistical tests are apparently not being applied to the resulting data.

One limitation of the current IDNR sampling approach with regard to sampling frequency is that the program has traditionally focused on assessing ambient conditions to the exclusion of more episodic events such as storms. Nonpoint source pollutant concentrations in streams can increase dramatically as a result of storm-induced increases in runoff and a program focused exclusively on ambient conditions would likely miss such spikes in pollutant concentrations. Furthermore,

event sampling for such runoff driven contaminants as sediment, pathogens, and phosphorus is crucial for the development of effective TMDLs. IDNR has recently taken steps to partly fill this data gap by targeting select stations (one in each ecological region, for a total of 7) for sampling during runoff events. IDNR should consider developing a plan for expanding this event sampling effort by identifying additional locations to provide a coverage of a broader range of runoff and nonpoint source conditions.

4.6. Other Issues in the Monitoring Program

This section identifies issues in IDNR's surface water monitoring program not detailed in the foregoing sections. The monitoring issues listed here are based, in part, on concerns identified by a joint EPA/IDNR work group that completed an evaluation of Iowa's ambient water quality monitoring program. Possible responses to highlighted issues referenced in this section were developed in coordination with the IDNR.

Comprehensive Coverage of Wetlands

The state of Iowa has thousands of acres of both public and privately-owned wetlands which can be categorized as permanent, semi-permanent, temporary, and seasonal. While no definitive inventory of all of Iowa's wetland resources currently exists, over 27,000 acres of Iowa's publicly-owned wetlands have been classified by IDNR as having an aquatic life designated for beneficial use (IDNR 2001). Historically, IDNR has based assessments of an individual wetland's support of aquatic life uses on the best professional judgement of biologists within IDNR's Wildlife Bureau (IDNR 2001).

According to IDNR, IDNR is taking a series of coordinated strategic steps in improving their surface water monitoring program. These "steps", in the form of a series of pilot projects, are designed to provide a scalable (to the ecoregion and state levels), holistic (both biological and chemical) and effective monitoring and assessment program for all of Iowa's wetlands. These strategic steps and projects will be coordinated, documented and linked through this Strategic Monitoring Plan and will include, but not be limited to, the following 1) a "Color Infrared Digital Orthography Project" to identify and inventory all of Iowa's wetlands (permanent, semi-permanent and temporary), 2) establishment of a wetlands technical advisory committee to help define appropriate monitoring protocol and assessment methodologies, 3) a R-EMAP pilot project for probability-based wetlands monitoring to assess baseline biological and chemical conditions, 4) a wetlands biological indicator development project (similar to Iowa's existing stream biocriteria development program), and 5) a reference site development and testing program. Funding for the linked projects will be sought through appropriate channels and sources such as CWA Section 104 or 106 appropriations. Other actions being contemplated by IDNR to address this issue include: an evaluation of the ability of existing functional models to provide information on the relative quality of individual (specific) wetlands and an evaluation of the methods used by other states to assess whether wetlands meet WQS and the potential relevance of those standards for assessing Iowa wetlands (IDNR 2002).

The ultimate goal of developing this wetland monitoring program is to positively affect the quantity and quality of data and information available for the effective protection and management of all of Iowa's wetland resources by enabling the following activities:

1) The development of a wetland monitoring and assessment methodology to be used by the Iowa Department of Natural Resources to conduct wetland monitoring as part of the state's ambient water quality monitoring program;
2) A periodic assessment (status and trends) of the condition and stressors of Iowa's wetlands;
3) An assessment of the effectiveness of wetlands toward meeting nutrient management goals;
4) The setting of appropriate water quality and biological standards for wetlands protection;
5) Reporting of wetland conditions to the citizens of Iowa.

Comprehensive Coverage of Large "Border" Rivers

Iowa has a limited monitoring presence on the state's large border rivers which consist of approximately 660 miles of the Upper Mississippi and Missouri rivers. A program to increase monitoring, Great Rivers EMAP, began in 2004. The USGS received funding from EPA to conduct monitoring on the Mississippi and Missouri Rivers. Long-Term Resource Monitoring Program (LTRMP) took the lead on the Mississippi River. USGS was the lead on the Missouri River project. Nebraska was the lead for fisheries work, Iowa was the lead for biological monitoring/habitat, and USGS was the lead for water chemistry. IDNR staff conduct routine water quality monitoring on the Mississippi River and several Iowa tributaries as part of the USGS (LTRMP). IDNR does not, however, conduct water quality monitoring on the Iowa reach of the Missouri River. According to IDNR, the decision not to monitor these border rivers as part of the IDNR's enhanced water quality monitoring program was also based on input from citizen and technical advisory committees, which felt that Iowa's monitoring resources should not be devoted to monitoring of interstate rivers.

Even though Iowa does not conduct their own monitoring on the Mississippi River, IDNR has reviewed data collected through the LTRMP with the intent to use that data in their 305(b) assessment. However, IDNR's review of the LTRMP data found it to be of limited utility. The focus of the LTRMP program has been on data collection rather than analysis. Further, the data collected under the LTRMP program specifically targets factors that affect aquatic life and aquatic habitat trends, but biocriteria for use in establishing impairment of large rivers have yet to be developed. The state is searching for a methodology to use the LTRMP data for determining use impairment. The LTRMP data is also limited in that it is restricted to Pools 4, 8, 13, 26, La Grange Pool of the Illinois River and the Open River Reach, miles 29-80, of the Mississippi River. Available guidance provides little direction on how such isolated data could be used to evaluate impairment of other pools or segments of the river (i.e. if two Mississippi River pools show apparent impairment, it does not necessarily follow that the intervening river segment or pool(s) are also impaired). This sampling program, which is administered by USGS and contracted through the IDNR, has also suffered significant cuts in funding in FY03 and these cuts will further hamper the state's ability to monitor and assess conditions on the Upper Mississippi.

To partly address this monitoring deficiency, IDNR is committed to developing and executing, in cooperation with EPA Region 7 and EPA's Office of Research and Development, the EMAP - Central Basin project (EMAP-CB). EMAP-CB will attempt to develop the necessary tools (including indicators and sampling techniques) and partnerships to institute a probability based monitoring project aimed at assessing baseline biological, chemical and habitat conditions for the Missouri and Mississippi Rivers. Cooperative regional monitoring agreements between the Upper Mississippi River states and federal agencies such as the USGS could also help bridge this monitoring gap and should be pursued. The level of success of those attempts will likely depend upon the availability of matching funds with cooperating states and federal agencies.

While the EMAP project is a good starting point and will allow development of key tools and indicators, it is currently unclear whether the scale and frequency of sampling within this probability-based monitoring project would be sufficient to target all discrete larger border river segments for monitoring and assessment. All river segments with designated beneficial uses will ultimately need to be targeted for monitoring and assessment.

Federal guidance is also needed to establish/promote methods for assessing impairment in large rivers such as the Mississippi, to identify the types of data that would be most useful for establishing impairment, and to outline appropriate methods for using data collected from widely separated points in assessing impairment of larger river segments (as appropriate).

Trend analysis is an example of a method commonly used in the Mississippi River pools to assess changes to aquatic life but states have not traditionally used this type of data for establishing impairment and, therefore, use of such data for 303(d) listing purposes will also require direction on how trend analysis is best used for that purpose.

Beyond federal input, regional agreement must also be reached among the states on what parameters in big rivers should be monitored and what benchmark(s) should be used for establishing impairment. Such agreement is crucial for border rivers that separate states and that will require the cooperation of two or more states to alleviate any impairments.

Non-significant Public and Private Lakes (including Ponds)

Iowa has three general categories for lakes in its monitoring program: significant public, non-significant public and private with public access. Private lakes without public access are not covered in its monitoring program. Significant public lakes are defined as: 1) principally maintained for public use, 2) have a minimum surface area of 10 acres, 3) are capable of supporting fish stocks of at least 200 lbs/acre, 4) have a watershed to lake surface area ratio of less than 200:1, and 5) are not shallow marsh-like lakes, federal flood control impoundments, or used solely as water supply reservoirs. Non-significant public lakes carry essentially the same definition except they are smaller than 10 acres or are used primarily as water supply reservoirs. The definition of private lakes with public access is self-explanatory. All publicly owned lakes have WQS defined within the Iowa Administrative Code. The existence of WQS for privately-owned lakes with public access depends on the beneficial uses designated for the stream or river impounded to form the lake. Typically, privately-owned lakes receive the same level of protection as does the stream either entering or leaving the lake.

While the IDNR surface water monitoring program currently actively surveys all significant public lakes, reservoirs and state-owned beaches through a census design, only 17 of the 164 non-significant public lakes and none of the 12 or so private lakes with public access are sampled. Furthermore, sampling of the non-significant public lakes appears to be achieved using a targeted design which does not represent the entire population. Inventories of the non-significant public lakes and private lakes with public access categories appear to be either incomplete or in need of updating.

IDNR has committed to evaluating the distribution of these lakes and developing an appropriate monitoring design. The inventories of private lakes with public access and non-significant public lakes will also be reviewed and updated, as appropriate. A GIS overlay of these lakes may also be developed.

Given the relatively small size of the population of non-significant public lakes and private lakes with public access, overlaying and implementing a probability-based design could be relatively easily accomplished, given the state's expertise with other probability-based projects, and would provide reasonably comprehensive coverage with a known degree of scientific confidence. However, a complete inventory of these lakes would first need to be completed. In addition, if biological end points were needed to make assessments relative to state WQS, then a process for developing biological indicators and reference sites would need to be established. This latter process, if needed, would constitute a significant investment in both resources and expertise.

Intermittent Streams

The state of Iowa has an estimated 43,000 miles of intermittent streams but conducts only limited monitoring on those streams. Intermittent streams are undoubtedly an important aquatic ecological resource and techniques for assessing the condition of such streams should be further developed by IDNR in the future.

One potential option for addressing the lack of intermittent stream data could be the training of participants in IOWATER to conduct screening level assessments on intermittent streams. Viability of such an approach would be dependent upon both the development of bioassessment tools designed to determine the ecological health of intermittent streams and the ability of IDNR to "upgrade" the training of volunteers to the level of being capable of collecting data in accordance with a sampling and analysis plan with appropriate QA/QC procedures. Progress was made in 2004 to expand surface water monitoring and to improve volunteer collected data (IDNR, 2004).

More in-depth assessment using bioassessment tools and extensive water chemistry analyses is likely currently beyond the scope of IDNR's monitoring program, given current demand on resources and the existence of higher priority monitoring issues.

Precipitation/Air Deposition

Impacts to surface waterbodies resulting from precipitation or air deposition of pollutants such as nutrients, pesticides, and antibiotics is a significant but unquantified concern in Iowa due to a lack of monitoring.

EPA Region 7 has identified a need for an air deposition monitoring network for the Region and will attempt to coordinate the development of such a network with the individual states within the region and the air monitoring program. As an initial step in the development of such a network, a pilot project developed in partnership with the states is envisioned that could be funded with R-EMAP or air program funds.

The USGS currently operates two wet/dry deposition monitoring stations within the state of Iowa and IDNR is committed to working to ensure the continuity of these stations. IDNR also intends to explore cooperative efforts with the USGS and other federal agencies to expand the limited existing network to include additional stations in critical watersheds. Partnerships with the Air Quality Bureau of IDNR could also be pursued to build upon existing air compliance monitoring by adding wet/dry deposition equipment.

Stream Gaging Data & Stations

Stream flow measurements are a necessary component of many of the Department's water quality activities including NPDES permits, TMDL development, floodplain permits, and water quality modeling. Stream gaging has traditionally been administered through cooperative agreements with the USGS but this program has suffered funding cuts at both the state and federal level over the past decade. Continuous stream gaging at smaller stream sites is largely nonexistent at the current time and the lack of such stream flow measurement data negatively impacts TMDL development on listed streams.

IDNR has ranked the existing gaging stations relative to their value to the various water quality programs and their potential for being funded through partnerships with various governmental agencies (municipalities, counties, DOT, USDA, etc.). IDNR also intends to establish a prioritized list of potential new gaging sites that will be submitted to partner agencies for proposed funding. IDNR also continues to work with the USGS to request new gaging stations under the National Stream Information Program (NSIP). IDNR also intends to pursue new funding partnerships and will attempt to get State General Fund appropriations restored to former levels by alerting the legislature to the threat that a lack of stream gaging data poses to many of the state's water quality programs.

Biological Indicators and Reference Conditions for Assessing Lake Health

The development of adequate lake WQS for such parameters as Nutrients, Phosphorus, and chlorophyll-a is directly dependant upon the existence of a monitoring system capable of defining reference conditions and corresponding deviations. TMDL development also depends upon the existence of adequate monitoring data from lakes and tributaries. IDNR currently conducts census-type sampling on its significant public lakes, but lake assessments are hampered by the following factors:

1) lack of biological indicators calibrated for Iowa lakes;
2) lack of reference conditions developed for Iowa lakes;
3) concerns about the spatial and seasonal representativeness of sample collection strategy;
4) detection level for total Phosphorus needs to be appropriate for the development of standards;

5) flow measurements and event sampling on contributing streams needs to be adequate to validate load calculations;
6) accurate lake modeling may require continuous tributary flow monitoring, continuous discharge monitoring, and bathymetry for some sites;
7) fisheries and biological assessments are needed as a basis for determining if TMDL targets are being achieved; monitoring and modeling need to provide the connection between the assessment and the water quality problem indicator (sediment, P, N, chlor a, etc.);
8) sediment coring is needed to provide deposition history and an understanding of how sediment nutrients are recycled in the water column.

On the issue of biological indicators, IDNR will proceed with indicator development in cooperation with the Iowa technical committee and will take into account what other states have done. Current efforts to develop a lake classification system that takes into account lake data collected by the IDNR fisheries may support the development of biological criteria. The state TMDL program is currently contracting with the USGS to collect bathymetry and sediment coring.

Validation and Refinement of Biological Indices to Appropriate Eco-region Scales

IDNR has been actively developing biological criteria for fish and macroinvertebrates to facilitate determining aquatic life use support. These biological criteria require further refinement and validation before they are used to make meaningful assessments. In particular, the linkages between biological parameters, habitat and water chemistry must be more thoroughly documented to support the biological criteria program.

IDNR plans to continuously improve their biological criteria through the routine collection of data from their enhanced monitoring network. IDNR is also considering the use of multi-variate approaches to strengthen their bioassessments by correlating habitat measures, such as sediment and channel morphology, to these indices.

Characterization of Reference Conditions for all Resource Classes but especially Large (non-wadeable) Streams

In order to properly assess the condition and degree of impairment of the state's water resources, appropriate reference sites must be identified and used in the assessment process. In Iowa, as in many other states dominated by agriculture, this task is made more difficult by the general deficit of undisturbed sites. This problem is especially acute for the large non-wadeable streams, particularly those interior streams crossing eco-region boundaries.

Identification of new sites with potential as reference sites may be facilitated by the R-EMAP projects for wadeable streams and wetlands. For the larger non-wadeable streams, the following activities may help locate undisturbed reaches: use of GIS tools to isolate point and non-point sources, identification of land use and land cover types expected to minimize impact, and review of observations and recommendations made by field agents regarding new sites and watersheds that could potentially be useable as reference sites. Other possible strategies for assessing non-wadeable streams include: adaptation and application of wadeable stream methods, such as use of artificial substrates, to non-wadeable streams and tasking CPCB to synthesize information on

tools and indices being used by other states in the Midwest for assessing non-wadeable streams. With regard to chemical criteria, IDNR is working with the RTAG work group to develop draft nutrient criteria for lakes and streams.

City and County-owned Beaches

The state of Iowa has an indeterminate number of city and county-owned beaches where the frequency and quality of monitoring is unknown. Furthermore, the development of any approach to deal with this data gap is complicated by the fact that responsibility for the monitoring of city and county-owned beaches is currently unresolved.

IDNR has committed to the development of an inventory of city and county-owned beaches and will provide assistance to local organizations in the development of monitoring programs for those beaches. However, IDNR intends to defer beach closure decisions to those local organizations.

Adding Historical Biological Record to Assessments

Settlement history in Iowa resulted in losses to its aquatic biological resources. The addition of a historical component to Iowa's aquatic assessment would be beneficial to understanding the degree and impact of the historical biota loss.

4.7. 2002 Section 303(d) Listing Methodology

The Section 303(d) listing methodology currently being followed by IDNR, as summarized in the document entitled *Methodology for Developing Iowa's 2002 Section 303(d) List of Impaired Waters* (IDNR 2002), includes the basic program elements required by 40 CFR 130.7 and generally conforms to recommendations outlined in the various applicable EPA guidance documents (EPA, 1991, 1993, 1997, 2003). IDNR classifies data reliability as required and qualified data are compared to WQS to make use support determinations. In assessing use attainment, IDNR typically sets criterion based on a maximum, an average, or a percentile. However, EPA also recommends statistical verification that the criterion has been attained through use of an appropriate statistical test (EPA 2002).

The following issues were taken from *Methodology for Developing Iowa's 2002 Section 303(d) List of Impaired Waters* (IDNR 2002):

Iowa's Credible Data Law

Iowa's "credible data law" specifically exempts waterbodies assessed as being impaired from inclusion on the Section 303(d) list when existing technology-based limits or other required pollution control measures are adequate to achieve applicable WQS. On the 2002 303(d) listing, impaired waterbodies are also exempt from listing where failure to attain WQS is solely the result of violations of NPDES program permits or stormwater permits and the enforcement of the pollution control measures is required. However, IDNR's May 2005 report, entitled *Methodology for Iowa's 2004 Water Quality Assessment, Listing, and Reporting Pursuant to Sections 305(b) and 303(d) of the Federal Clean Water Act,* appears to be consistent with federal

regulation and EPA guidance regarding the treatment of water quality impairments where other pollution control requirements or an NPDES permit are expected to result in the attainment of water quality standards. Placement of a waterbody within Category 4b under EPA's recommended Integrated Report format requires that the State demonstrate that the effluent limitations or other pollution control requirements attain all water quality standards and attain those standards in a reasonable period of time. In its review of the State's submission of its final 2004 list of impaired waters (i.e., Category 5) and response to public comment, EPA will monitor whether implementation of IDNR's methodology results in listing decisions consistent with these requirements.

Waters in Need of Further Investigation

According to Iowa's credible data law, waterbodies where an assessment indicates a potential impairment, but where the assessment lacks "credible data" are placed on a list of "waters needing further investigation"(IDNR 2002). According to IDNR, such waterbodies include:

- publicly-owned lakes added to the 1998 303(d) list based upon "best professional judgement" which are currently monitored but have not been assessed in 2002 as being impaired (20 lakes were added back to the 2002 303(d) list on July 11, 2003),
- publicly-owned wetlands placed on the 1998 303(d) list on the basis of "best professional judgement" and for which appropriate monitoring programs and assessment criteria have yet to be developed,
- and river and stream segments where monitoring has indicated a potential impairment, but data does not currently meet quantity or quality requirements (IDNR 2002).

4.8. TMDL Development and Monitoring Recommendations

Cross-program Coordination

Cross-program coordination could be enhanced between the ambient monitoring program and the TMDL program, particularly with implementing monitoring plans on major interior river basins and monitoring commitments for phased TMDLs.

Monitoring plans are being developed and implemented on the Cedar and Big Sioux Rivers. Such monitoring programs require periodic modification. However, adequate resources are not currently available to continually assess accumulating flow and sampling data, to inventory pollutant sources, and correlate monitoring data to watershed hydrology and characteristics. A monitoring plan for the Racoon River has yet to be completely developed.

Phased TMDLs are written when there is inadequate information available to establish final loadings. Since a phased approach is being used to develop TMDLs in Iowa, monitoring commitments are essential – as with any phased approach to TMDL development.

Sediment Data for Evaluating Impact of Bed and Bank Erosion

Bed and bank erosion appears to be a major contributor to several identified stream sediment and siltation impairments in Iowa, but rigorous methods for evaluating these sources of impairment

are currently lacking. The Agricultural Research Service and a regional work group have been working on a stream channel evolution model and other sediment evaluation procedures that may yield monitoring strategies.

Event Sampling

As indicated previously, stream flow measurements, including event sampling, are crucial for TMDL development. However, but most smaller streams in Iowa have never been gaged and storm event data is entirely lacking. Furthermore, given current funding constraints, establishment of continuous stage monitoring appears to be beyond the current capacity of the program. To deal with this significant data deficiency, IDNR hopes to develop its own ability to gage small streams using new technologies such as Doppler Radar, which has been successfully implemented in other states (Minnesota). Other options include renting a suite of portable flow monitoring equipment which could be moved to different locations as needed.

4.9 Areas in Need of Additional Study

Prior to completion of the final report evaluating IDNR's surface water monitoring program, additional review and evaluation will be undertaken in the following areas: use of specific models in decision-making and their appropriateness, particularly with regard to TMDL development; use of specific statistical tests for verifying compliance with WQS; and, following completion of all sections of Consolidated Assessment and Listing Methodology (CALM) or future EPA guidance documents, the degree of compliance of IDNR assessment process with those new guidance document (IDNR did not attempt to come into compliance with the new CALM guidance for 2002).

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ACRONYMS

CAFO	Concentrated Animal Feeding Operation
CALM	Consolidated Assessment and Listing Methodology
CPCB	Central Plains Center for BioAssessment
CWA	Clean Water Act
DO	Dissolved Oxygen
DOT	Department of Transportation
FDA	Food and Drug Administration
EDAS	Ecological Data Application System
FTE	Full-time Employee
GIS	Geographic Information System
HHC	Human Health Criteria
HUC	Hydrologic Cataloging Unit
IAC	Iowa Administrative Code
IBI	Index of Biotic Integrity
IDNR	Iowa Department of Natural Resources
IGSB	Iowa Geological Survey Bureau
IOWATER	Iowa's Volunteer Monitoring Program
ISU	Iowa State University
LTRMP	Long Term Resource Monitoring Program
MCL	Maximum Contaminant Level
NASQAN	National Stream Quality Accounting Network
NAWQA	National Water-Quality Assessment
NPDES	National Pollution Discharge Elimination System
NRCS	National Resource Conservation Service
NSIP	National Stream Information Program
PAH	Polycyclic Aromatic Hydrocarbons
PBT	Persistent Bioaccumulative Toxics
QA/QC	Quality Assurance/Quality Control
R-EMAP	Regional Environmental Monitoring and Assessment Program
RLWA	Rathbun Land and Water Alliance
RTAG	Regional Technical Advisory Group
SDWA	Safe Drinking Water Act
SSURGO	Soil Survey Geographic Database
STORET	EPA's Storage and Retrieval Database
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
TSI	Trophic State Index
UHL	University Hygienic Laboratory
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
EPA	United States Environmental Protection Agency
USFS	United States Forest Service
USGS	United States Geological Survey

Comment: As mentioned in the report, we are concerned that the IDNR report is incomplete because it does not have a schedule for funding or enactment of the IDNR's own recommendations.

Response: As noted in the comment this concern is identified in the interim report on p. 36; "A failing of this document is that it lacks a clearly articulated time-line or schedule for requesting funding and enacting program recommendations." It is the intent of EPA & IDNR to incorporate schedules into existing monitoring grant workplans ensuring progress toward addressing the strategic recommendations. See section RE-MAP on page 6 of this report. See also the EPA grant for Wadeable Steam Assessment on page 11 of this report. Formation of a wetland technical advisory group began in April of 2004 and has met four times during the past year (IDNR 2005). A quality assurance project plan has been submitted to EPA as of April of 2005. The sampling frame was delivered to EPA Office of Research and Development in April of 2005 and sampling is projected to begin in 2005 (IDNR 2005). IDNR received a wetland development grant to develop a rapid assessment method for Iowa fens (IDNR 2005).

Comment: We agree with the EPA recommendation to increase funding for the water monitoring program. The funding should be used for the "get wet" work and not just the paperwork.

Response: EPA encourages IDNR to work with stakeholders in development of funding priorities and continue efforts to utilize the IOWATER volunteer monitoring program in addressing State monitoring needs. Further details with regard to monitoring program funding are addressed in the *Comprehensive Report of Ambient Water Quality Monitoring Programs in Iowa, Part C: Threats to the Monitoring Program*. Also see IDNR's *Water Monitoring Program Highlights 2004,* where the *Citizen Volunteer Monitoring* section chronicles the success of Iowa's 55 snapshot monitoring events and discusses that more than 2,600 sites have been registered by IOWATER monitors representing more than 13,000 data records.

Comment: As written in the report, we agree IDNR should expand the level of training provided to volunteers beyond the current two levels. They also should make provisions to accept the data collected and recorded by the trained monitors. We feel the guidance on the preparation of quality assurance projects is totally inadequate, especially in view of the fact that we must have this document for our data to be credible.

Response: As noted in the *Comprehensive Iowa Monitoring Report*, pages 10 & 11, modifications in the IOWATER volunteer program are being incorporated. Guidance on preparation of quality assurance project plans is also provided to ensure that the data volunteers collect is of high quality (IDNR 2004). IOWATER testing methods continue to be assessed for credibility (accuracy and precision). Ongoing comparison of the data to professionally collected data show confidence in IOWATER results and methods. Methods that are acceptable for 305(b) assessment are also being investigated (better detection limits, resolution) (IDNR 2005). (Page 13) Also noted on page 11 of the *Comprehensive Report of Ambient Water Quality Monitoring*

Programs in Iowa is an acknowledgment that the use of voluntary data in 303d and TMDL development will need to be weighed against the state's credible data law as well as appropriate QA/QC considerations (IDNR 2004b).

Comment: We agree continuous stream gauging is largely nonexistent. What is being done to increase this gauging or review of volunteer data to identify problem areas which would suggest the need for additional professional monitoring?

Response: Page 48 of this report addresses this comment, providing IDNR's strategy and outlook to address the need for continuous stream gauging. IDNR also intends to establish a prioritized list of potential new gaging sites that will be submitted to partner agencies for proposed funding. IDNR continues to work with the USGS to request new gaging stations under the National Stream Information Program (NSIP). IDNR intends to pursue new funding partnerships and will attempt to get State General Fund appropriations restored to former levels by alerting the legislature to the threat that a lack of stream gaging data poses to many of the state's water quality programs (IDNR 2004b).

Comment: Waterbodies should not be exempt from the 303d list when the impairment is permitted by the NPDES program, if the impairment continues to the next listing cycle. What is the EPA going to do about these continued violations?

Response: This comment refers to legislation enacted by the Iowa General Assembly addressing "the use or analysis of credible data" by IDNR in developing its Clean Water Act section 303(d) list. Federal regulations at 40 CFR 130.7(b)(1)(i) and (ii) and EPA guidance issued for the 2004 listing cycle provide for placement of waters in a category other than that which would constitute the states' impaired waters list if existing effluent limitations under an NPDES permit will lead to attainment of all water quality standards in a reasonable period of time. Not withstanding the State's "Credible Data Law," IDNR's May 2005 report, *Methodology for Iowa's 2004 Water Quality Assessment, Listing, and Reporting Pursuant to Sections 305(b) and 303(d) of the Federal Clean Water Act*, is consistent with federal regulation and EPA guidance regarding the treatment of water quality impairments where an NPDES permit is in place. EPA expects IDNR to provide appropriate documentation demonstrating that the existing permit will support attainment of water quality standards in a reasonable period of time. Compliance violations of such permits are appropriately addressed through the enforcement responsibilities of both IDNR and EPA.

Comment: Why are lakes and wetlands allowed to be grouped in the same classification, rather than being viewed separately?

Response: This comment refers to page two of this report, "The current estimate of wetland acreage in Iowa is 50,271 acres, although the state has adopted no formal generally accepted definition of "wetland"... No distinction is made between "lakes" and "wetlands" in the Iowa Water Quality Standards..." Please refer to page 13 of this report and IDNR's 2005 report, *Water Monitoring Program Highlights 2004*, where information on IDNR's efforts to update their National Wetland Inventory are discussed.

Comment: The IDNR/EPA need data on small streams and need to be able to use the data that is available, whether volunteer or professional. IDNR should develop plans for how they are going to get this available data and put it to use.

Response: Waters in need of further investigation, including small streams as noted in the comment above, are addressed in IDNR's *Comprehensive Report of Ambient Water Quality Monitoring Programs in Iowa* which states that strategies include working with local watershed groups and municipalities and appealing to the Governor for monies earmarked for this specific type of follow-up monitoring. Also referring to the section on Database coordination in IDNR's 2005 report, *Water Monitoring Program Highlights 2004*, IDNR reports that this sort of data coordination is under development through a state contractor (Gold Systems, Inc.).

Comment: If event monitoring is an EPA requirement, then the instructions should be built into and included as part of the IOWATER training.

Response: IDNR has recently taken steps to partly fill this data gap by targeting select stations (one in each ecological region, for a total of 7) for sampling during runoff events. IDNR should consider developing a plan for expanding this event sampling effort by identifying additional locations to provide a coverage of a broader range of runoff and nonpoint source conditions, refer to section 4.5. of this report.

Comment: Does the EPA or IDNR intend to monitor the progress of the phased TMDL's and what type of reporting will be done for the public information?

Response: Due to the variability of each TMDL, monitoring plans are designed with the specific TMDL in mind. Details of the monitoring plans may be reviewed within each TMDL. All TMDL's are public information and may be viewed on the EPA's website at internet address: *http://www.epa.gov/region07/water/apprtmdl.htm*.

Comment: After reviewing the Monitoring Report [this report], we question why a private lake, such as Holiday Lake or Ponderosa Lake, with access by 1000's of people, would not fall under the purview of the IDNR or EPA.

Response: Iowa has three general categories for lakes it considers within the purview of its monitoring program: significant public, non-significant public and private with public access. The state currently does not consider private lakes without public access to be within its purview. The existence of WQS for privately-owned lakes with public access depends on the beneficial uses designated for the stream or river impounded to form the lake. Typically, privately-owned lakes receive the same level of protection as does the stream either entering or leaving the lake. Please refer to section 4.6 of this report for more discussion of Iowa's lake water standards.